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VOL. LIX, No. 1539

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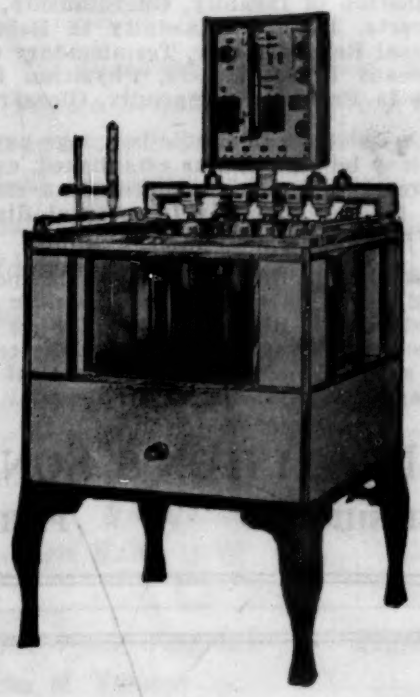

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SCIENCE

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SCIENCE: A Weekly Journal devoted to the Advancement of Science, edited by J. McKeen Cattell and published every Friday by

THE SCIENCE PRESS

Lancaster, Pa. Garrison, N. Y.

New York City: Grand Central Terminal.

Annual Subscription, $6.00. Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the association may be secured from the office of the permanent secretary, in the Smithsonian Institution Building, Washington, D. C.

Entered as second-class matter July 18, 1923, at the Post Office at Lancaster, Pa., under the Act of March 3, 1879.

SCIENCE AND SCIOSOPHY[1]

"Quand la vérité est fantaisiste la fantaisie n'a qu'être vraie."—Ferdinand Brunetière.

SCIOSOPHY is systematized ignorance. Its nature was indicated more than three hundred years ago by Giordano Bruno in Florence, who for this and other heresies, for example, wanton denial of the concentric crystalline spheres of heaven, insistence on the infinite extension of the universe and in the plurality of worlds, was later appropriately punished. "Ignorance is the most delightful science in the world because it is acquired without labor or pains and keeps the mind from melancholy."

The word *sciosophy* (shadow-wisdom) was coined by me in 1899 to meet a long-felt want. Sciosophy in action is called *magic;* latent magic is *mystery.* It differs from ordinary science in its basis. It is not derived from tested and verified human experience, because life is short and humanity demands quick returns. It recognizes no relation of cause and effect, for these are mere human devices. Instruments of precision, logic, mathematics, the telescope, the microscope and the scalpel, are not needed in sciosophy. Its processes are instantaneous and intuitional while all scientific testing is slow and laborious. It is indeed folly to wait for this, when tradition, memory, impulse, imagination are all at hand pointing straight to truth or at least indicating that one conception is as good as another, if not better. My interest in sciosophy, or more exactly in creating a word by which to define it, was provoked by a volume called, in English translation, "Posthumous Humanity, a Study of Phantoms," by Dr. Adolphe D'Assier, a member of the Academy of Sciences at Bordeaux. In this remarkable work are given many illustrations of the spontaneous activity of astral doubles and even of ordinary shadows. It is, in fact, a complete "fauna of the shades," in which are included all manner of wraiths, shadows and phantoms, some of them lycanthropic (wolf-manly), some of them derived from astral doubles, and still others due to the expulsory force of the sun.

The nature of such organisms is easily understood without use of the tools of precision, in fact, here as elsewhere in sciosophic truth instruments are quite unnecessary, except for the purpose of impressing the spectator. It is now well known that all animals

[1] Address of the President, Pacific Division of the American Association for the Advancement of Science, at Stanford University, June 26, 1924.

and plants are built up of cells or chambers, each one charged with magnetic life jelly or protoplasm. These cells are never completely filled with this substance, which is in reality not a fluid but a vivified network, like a skein of tangled yarn. Into the cell with its network the odic forces of the universe penetrate, and by their entanglement and permeation build up within a form corresponding in all respects to that of the creature as a whole. It is, however, not the original, but its double or negative, being solid only when the cell is empty and empty when the cell is solid. This theory is amply verified by the observations of Mr. William Q. Judge, an eminent expert in Medusas, who has discovered that "the body of the jelly-fish is almost pure astral substance."

But greater interest attaches to human phantoms, and especially to the activities of shadows, the most abundant constituent of the fauna of the shades. A most remarkable case is that of Herr Peter Schlemihl, as related by the Baron Adelbert von Chamisso, himself a man of science, the discoverer of our own California poppy, to which he gave the romantic name of *Eschscholtzia*.

It seems that Herr Schlemihl, of Kunersdorf, was once approached by a stranger, gray-bearded and dignified, in fact, a Master of Arts. This gentleman expressed to Schlemihl a desire to purchase his shadow. A high price was named and promptly accepted. Thereupon the stranger knelt on the grass, rolled up the shadow, folded it neatly and thrust it into his knapsack, disappearing down the road between two hedges of roses, leaving Schlemihl himself absolutely shadowless.

At first the poor man thought he had made a good bargain, but afterwards whispered words and doubtful glances warned him that he was marked as a shadowless man. His anxiety over this fact gave him real discomfort. He set out in search of the shadow, and after many adventures he overtook the grave and serious individual to whom he had sold it.

But neither offers of money nor blows of the fist availed anything. To the former the stranger turned a deaf ear, and to the latter he used the shadow for protection. To struggle for it only served to damage the precious article itself. When Schlemihl died at last it was noticed that he left no wraith to rustle through the old graveyard at Kunersdorf. The baron who relates this story remarks sagely that "an event had taken the place of an action, as has happened not infrequently in the world's history." This cryptic utterance is of itself typical of sciosophy. If one meaning does not satisfy, hunt up another. In Schlemihl's days such events were usually ascribed to the devil. But this can not be, as sciosophy gets along without him (or with him, as the case may be). At the most he is but a "fabled fancy of an elder world, the fluidic phantom of effete orthodoxy." The fact that the stranger was dressed in black, which by transmitted light looked reddish, and that his breath exhaled a faint sulphurous aroma favored the common superstition. A highly concentrated odic aura probably accounts for this.

A rather well-authenticated record of the separation and independent life of a shadow is given by Mr. H. C. Andersen, of Copenhagen, a careful observer of occult phenomena. It appears that a Danish country gentleman of good family once lost his shadow. This did not worry him much until his strength began to give way and his clothing grew alarmingly brittle. Still worse, while confined to his room, he got wind of strange pranks performed by his double who seemed trying to undo him by bringing him into ridicule. At last the phantom usurped his master's place at the head of the table. After this, in burning indignation, by a supreme effort of the will the gentleman recalled the phantom, to the endless mystification of the guests at the function. After this effort, his vigor returned and his new suit ordered direct from Copenhagen showed no deficiency in stamina. This experience demonstrates that the phantom man wears phantom clothing. All wraiths recorded, though usually in night attire, appear to be properly dressed, else indeed they would be rushed by the police. The facts in this case are easily explained by the astral substance which fills the cloth cells of all garments. Phantom men wear phantom clothes, else their appearance would shock even the adept, a large percentage of adepts being ladies.

D'Assier has conclusively shown that even inanimate bodies have their doubles or phantoms as well as men and beasts. It is a matter of ancient observation that cliffs and trees show shadows as distinct as those of man. The "shadow of a rock in a weary land" is classical. That shadows may be detached and yet hold a sort of life of their own is well authenticated. In a curious tale by one Barrie of Edinburgh, a boy called "Sentimental Tommy" in running once turned a corner so suddenly that he "dislocated his shadow." It is easy to see how such an accident might occur, though not frequently. One Stevenson, also a Scotchman, tells of a boy who lost his shadow and of the embarrassments he met in consequence. In a child's book of verse I find that

> Little Willie lost his shadow
> As he walked across the meadow;
> Little shadow got away,
> Hasn't seen him since that day.

There is no doubt, therefore, according to the followers of D'Assier, that the shadow of a man or

a tree is an objective reality as much as man or tree itself. Phantoms are driven from their original status by the expulsory force of the sun. "The huge conical shadow of the earth which reaches beyond the moon and is called night" is not merely absence of light. It is a real thing and for all we know may help to hold the moon in place. Its appearance marks the hour of phantoms when the odic and fluidic forces of the earth are concentrate. It is natural that about midnight should be the clustering time of phantasms of all degrees, and so it is. In this period most successful studies of the natural history of the shades have been accomplished. It has been noticed that in daytime a shadow is seldom seen far from its host. Towards evening however, it asserts itself, stretching more widely, and in sleep it often becomes altogether detached, to be more or less painfully recalled in the morning.

According to D'Assier, after the death of his host the shadow wanders freely and at will. But not for long. The stars, arch enemies of shadows, soon begin to breathe and drink it up—l'aspirent et le boivent—and in ten to twenty days it is reduced to primeval vapor. The ever present fear of dissolution often causes phantoms to become violently excited. In spite of their freedom to move they tend to linger about original haunts. In a few cases they find a means to suck blood from living creatures, thus, as vampires, maintaining a precarious existence. It is asserted that the swift remedy for vampires is cremation. The testimony of peasants in Little Russia bears this out, and it is plain that once drawn into a current of hot air, no phantom could ever regain its pristine form. For this reason, burning at the stake was preferred in the Middle Ages to other penalties for lack of conformity.

"The phantom's most common yearning," says D'Assier, "is to bid the last farewell to those who were its familiars." But this can be but one of many motives, and it is never wise to read our own emotions into the vagrant actions of disconsolate shadows. At the best their span of independence is short. This is "a wise provision of nature, for otherwise the earth would be solidly full of shadows." "The accumulation of specters of the terrestrial fauna heaped at the surface of the globe since the first geological epochs would render the air irrespirable. We could not breathe a dense atmosphere of ghosts." This is the conclusion of D'Assier (p. 176) and chemical analysis of air in different localities seems to bear out his conclusions.

I need not dwell farther on the studies of D'Assier, but I may note their extension and expansion by other eminent adepts, such as Allan Kardec, Eliphas Levy, William Q. Judge, Henry Olcott, Karl Marx and others of world reputations. I may merely call attention to the line of thought as old as humanity and ranging in its subject-matter from the era of the witch of Endor to that of vitamine candy, the fourth dimension of space and the angel of Mona.

Unlike materialistic science which rests on mere sensory contact, sciosophy has a foundation of principles.

First, matter rests on mind. On mind it depends for recognition which is its sole existence. Its alleged laws are mental channels only, the grooves through which the spirit passes. With your will you can cut such grooves. You can frame your own laws.

The crude notion of cause and effect, so cramping to material science, is cast aside in sciosophy. Its propositions are proved by inversion, a simple process unknown to materialistic logic. Thus the great founder of Neminism asserts: "There is no pain in truth, therefore there is no truth in pain. There is no nerve in mind, therefore no mind in nerve. There is no matter in good, therefore no good in matter."

The motto of this cult, *"Nihil nemini nocet,"* is a fine illustration of the method, as in the expressive Latin the words can be arranged in three ways, always expressing the truth; this "Nemini nihil nocet," nobody hurts nothing, proves the original thesis: nothing hurts nobody.

It is rightly claimed that sciosophy is at once the complement, the opposite and the antidote to material science. For that reason, as the learned Dr. Alger, of Boston, has demonstrated, sciosophy is to be preferred to "the gutter-psychology of to-day." For, as he observes, "it brings no contact of the soul with vulgar matter"; not to touch matter is to deprive it of real existence. "It does not soil the hands nor blunt the sensibilities," and its final reflex effect is purely one of spiritualization. He especially commends the study of what he calls "Speculative philosophy [itself an exalted branch of sciosophy] to thoughtful people of leisure, and especially to cultured women," for the whole face of philosophy will be changed when permeated by the instant intuitions of the eternal womanly.

It happens indeed that the clean, quick methods of sciosophy appeal to many outside the inner circles of the cult. To get there quickly is better than to wait for a generation or two. Wherefore some devotees of the most exact science have used the "running high jump," a technical term for speculative philosophy, in matters in which the old system of trial and error seems unbearably slow. It is said of William Crookes, one of the greatest of physicists: "The fiery imagination of the discoverer of electrons would not be stayed by the balance or the burette." Hence his plunge headlong into sciosophy.

To advance by quick methods towards the infinite is one of the temptations alluringly held out to exact

sciences. An aeroplane moves more swiftly than a goods van, though it may carry less weight. And while art is long, time is fleeting, and to reach finality in a lifetime is a great aim of sciosophy. If external nature has no objective existence, and one thing is as true as another, this method of enlivening "funeral marches to the grave" is, as Bruno observed, most satisfying.

I quote from a distinguished physicist: "The human mind is a force which divests matter and bends it to its will . . . I will bend my finger, and the muscles of my finger obey and my finger bends. If mental force really exists, and can make dead matter move as it directs, why can't it work without the intervention of matter? The fact is that it can. . . . Every day we read items that tell of a man in America receiving a message from a relative in Africa, and many others beside myself have talked with dead friends. . . . Thought transference takes place just as easily between people in England and people in China as it does between people in adjoining rooms." This, it is claimed, can not be due to waves of any kind, for these become diffuse and must weaken as the square of the distance increases.

Sciosophy, as history tells us, was the basis of the wisdom of the Middle Ages. The Divine Right of the Church, that of the King, and in later times, the divine right of the state rested solidly upon it. They could have no other basis, as the tested results of human experience all point in other directions. In the thirteenth century the learned men, taught on this foundation, knew everything, or at least all that was worth knowing, for the world they lived in was a sink of iniquity soon to be destroyed and only by the blasphemous and impious ranged with the pure planets and the eternal stars.

It has been left for modern times to drag the purity of celestial conceptions into terrestrial mud. Not content with supplanting the divine power of direct action by Newton's law of gravitation, they have set aside the "fall of man" by the thesis of his "ascent from the brute." The protest against this profanation was finely voiced some years ago by a group of sciosophists in Columbia, South Carolina.

"Resolved, that Man was created by an instantaneous process without previous animal parentage." Quite recently a similar cult in Texas "reaffirms its historic stand that Adam's body was fashioned out of matter previously created out of nothing." Either of these in a single sentence as compact as any of Lyell, Darwin or Huxley, elucidates the origin of man. And if necessary the same truth could be proved by inversion. There is no man in animals, therefore there is no animal in man.

A definite assertion like this at once clears the air and closes the door against future heresies. For nearly 200 years the famous dictum of Archbish Ussher has held its ground in the field of religio "Heaven and earth, center and circumference, we created all together in the same instant, with clou full of water, on October 23, 4004 B. C., at ni o'clock in the morning."

Just as definite is this statement of a mode sciosophist:

"Whenever God gets ready to set this old world he has all the coal, the gas and the oil right in th old earth to fire it with and down inside the fire burning."

In an essay attributed to Lord Bacon (quoted b Harry Elmer Barnes), the story is told of the effo to find out how many teeth a horse has. Appeal wa made to the Fathers and to Aristotle, but without re sult. Finally someone suggested looking at a hors This was fiercely resented by the scholars. "Sata hath tempted this bold neophyte to declare unhol and unheard of ways of finding truth, contrary to a the teachings of the fathers." The disputants finall declared it to be "an everlasting mystery, because o a grievous dearth of historical and theological evi dence thereof—and so ordered the same writ down.

In political economy, sciosophy still rules th world. It requires neither telescope nor microtom to ensure its primacy. As a nation we have bee prosperous, and this according to sciosophy is du to the tariff. We have taxed ourselves rich. Thi we may prove by direction or by inversion. It need neither scalpel nor statistics, nor any effort of th mind. To use war as the means to settle dispute is perhaps the greatest triumph of sciosophy. Wa leads to peace, for when nations are thoroughly ex hausted it takes years to fatten them up. Therefor war-making is the surest means to bring about peace This truth is proved by inversion as peace is th surest road to war.

The most useful weapon devised for war is forge by sciosophy. It is known as "impersonal hate," the hatred of people of whom one knows nothing It is sometimes usefully called "patriotism," but tha ancient and revered word has other meanings. It truth is again proved by inversion. Let us assum that our military opponents are Hottentots. Ther is no Hottentot in Good, therefore no good in Hot tentots.

No discussion of sciosophy could be complet without recognition of its immediate personal values In the words of the man on the street, "there is good deal in it." The witchhazel rod is to many th staff of life. In the rush to the Klondyke thirty years ago, the vender of the rabbit's foot grew wealthier than the washer of pans of gold, especially if his quarry were obtained in a country graveyar in the dark of the moon. At the present time indus

tries based on sciosophy are especially repaying. War lifted the lid on society, and secret actions and beliefs held in the dark now dance openly on every green. For the aftermath of war is the heyday of temperamentalism, and of forty thousand other isms, social, political or religious, soothing to the soul and requiring no effort of the mind or hardening to the hands to secure them. "To live in two worlds at once" or at least in one "world with four dimensions" far from the distractions of realities appears as an ideal easily obtained and earnestly to be desired.

Dr. Harry Roberts, referring to the relations of Sciosophy to Medicine, says:

> Among the ultra-modern a feeling is spreading that these things (laboratory work) are at the best a little Victorian and old-fashioned, and that truth may be captured by less laborious and more dashing methods. Guessing is coming into fashion.

I find in the London *Nation* this account of a noted medicine-man of California:

> Dr. Abrams, possibly honestly obsessed by the researches in physics of Professor Rutherford and others, evolved the theory that all human sickness is due to faulty vibrations of electrons. He produced an instrument which he called an oscilloclast, whereby he alleged, these vibrations could be measured, and a complete diagnosis arrived at. By subjecting the sick man's electrons to the impact of vibrations corresponding with those responsible for the disease, a cure, he claimed might in all cases be effected. He believed or alleged that, by means of the oscilloclast (well defined by an American newspaper as "a contraption which might have been thrown together by a ten year-old boy who knows a little about electricity, to mystify an eight year-old boy who knows nothing about it"), he could determine whether an individual was a Catholic, a Seventh-Day-Adventist, a Theosophist, or a Jew. The real value of this instrument is well shown by the following report of the diagnosis made from a sample of blood submitted by Dr. Blue, of Michigan:
>
> "Congenital and cryptogenic syphilis; congenital gonorrhoea; carcinoma of stomach, small and large intestine, colon, pancreas, kidneys and bladder; epithelioma (not localized); sarcoma of spine; chronic malaria; diabetes. That may look like a formidable array of diseases to you, but it is not so bad from an electronic standpoint. I can not give a prognosis without a personal examination, but if all other things are equal your chances of recovery are very good."
>
> When it is explained that this blood specimen was obtained from a healthy Plymouth Rock cock, the optimism of the prognosis does not seem so misplaced.[2]

A fascinating phase of sciosophy is disclosed in the effort to probe the soul of the atom or to gauge the conscious feeling of a chopped tree. If the universe is alive, and whatever is alive has feeling, why not atoms, crystals and grains of sand, as well as amœbæ, salamanders and humanity? Marvelous are the achievements of the "Synthesis of Life," not a laboratory job, of course, but a task for the adept who creates life through juggling words, thus producing "a reasoned synthesis of the fabrication of protoplasm," even if he never sees protoplasm itself.

A touch of sciosophy may be traced in the work of those scientists who would cast aside Darwinism in the interest of making science more exact by purging it of variation. In Mr. Shaw's preface to "Back to Methuselah," the method is plainly indicated. Why not? May it not be true that a great philosopher may know instinctively more of the ways of creation than any plodding realist like Darwin, "in his greenhouse tying strings to his plants and making them do things"?

Authority on the one hand, a pillar to lean against, and sympathy on the other, a bosom to weep into, these are the chief demands of humanity in the mass. Both these sciosophy can furnish in full measure. No instruments of precision are necessary to set up authority or to set free the fountains of the soul, and these once flowing know no limitations of time or space. Esoteric dreams solace the future, absent treatment is better than present medicine. Its defiance of materialism proves its spiritual value. Sciosophy is ennobled by being set to work "to cure men of all ills whatever," says a high priest of the Neministic cult, "we have only to show them the stars. When we waken in the night only the sight of the stars . . . can tell us that we are awake. When we are awake all dreams must vanish, and all is dream which breaks the serenity of the mind. . . . We need not deal with the body for the body does not exist. It is dull, heavy and aching because it is the dead residuum of dream. When we forget it it is no longer there. . . . The body says, 'I am ill!' The reports of sickness may form a coalition with the reports of sin and say, 'I am malice, lust, appetite, envy, hate.' Treat a belief in sickness as you would sin, with sudden dismissal." To this in the cryptic fashion characteristic of sciosophy is added this great principle: "The equipollence of the stars above and of the mind below shows the awful unreality of evil." And as to this proposition one can have no reasonable doubt. And the whole ends with a sudden dash of worldly wisdom. With perfect faith in the unreality of external things it matters little what the practitioner does or leaves undone. Though money has no real existence the shadow in its substance proves that there is substance in its shadow. "The population of our cities," says the high priest lately quoted, "is ample to supply many practitioners, teachers and preachers with work. To enter this field of labor beneficially to ourselves it is necessary

[2] *The Nation and the Athenaeum*, April 12, 1924.

to demonstrate that the patient who is able to pay for being healed is more apt to recover than he who withholds a slight equivalent for health." Thus he who has paid for a touch of an old bone, a King or a blessed handkerchief, or for learning to say "To-day, to-day, in every way, I am getting better and better," is more likely to keep his faith than one to whom such favors come unasked. It is human nature to try to get the worth of one's money.

We may notice that followers of esoteric doctrine gather in cults, the choicest product of sciosophy. These yield in fact one of its best distinctive marks. There is no cult of objective science. It runs in another track and never seeks a majority vote.

I do not need before this audience to contrast sciosophy with science. Science is classified knowledge, no more, no less. The cardinal principle of science is that we know nothing until men find it out. There is no authority under heaven or above it that can give answers in advance to any question of fact. *"Roma locuta est, causa finita est,"* closes no scientific investigation. Science is human experience, tested and verified by our instruments of precision, telescope, microscope, scalpel, spectroscope, and those finer instruments of the mind itself, memory, logic and mathematics. Once its facts are obtained, they must be set in order. They must show relations of cause and effect, else they lead nowhere. "Facts are stupid things," Agassiz used to say, "unless they can be combined into truth," and to become truth facts must be stated in terms of human experience.

I have thus given, I trust, not unsympathetically, a few concrete examples of the most varied and most widely spread of all philosophical systems and the one most comforting to the human soul. Only a gigantic cyclopedia could tell the whole; I can only touch the fraying edge of a huge mantle which has enveloped humanity since it tasted its first knowledge of good and evil. It ranges throughout the universe from the cure of toothache and heartache through all the clustering multitudes of stars to its culmination in the ineffable, mouth-closing syllable of OM.

My own views may be tinged with it, for no one can escape from the atmosphere of his environment. To me the goal of human evolution is found in no single syllable but rather in reason, religion and love, and the central axis of these is reason or intelligence. Through the intellect, love and reverence are raised above the level of instincts. Each has its primal origin in simple relations. Intellect arises from reflex action, a complexity of tropisms. Love looks forward to the continuance of the race. Religion finds its initiation in fear and awe, culminating in reverence and duty. Each of these in its exalted reaches is upheld by intelligence, at once its backbone and its organ of vision.

Science, another name for knowledge, is our estimation of realities. There exists a parallelism between the actual character of objects in nature, and the impressions these objects make on the sensory organs and the nervous system of man and other animals. The impression which man sees or feels is not the object itself but object and impression run the same course, the one the inevitable effect of the other and the impression changing as the object changes.

The term *reality* is used in psychology to denote impressions on the mind or nerve center due to the impact of external impulse. It is an objective impression as distinguished from a subjective condition. Subjective appearances of reality seen by "the mind's eye" only may be illusions. An illusion at bottom is usually a fading memory, a continuance of a reality after its source has passed away. An untruthful interpretation of an actual reality is a delusion. Delusion and illusion form the subject matter of sciosophy, as reality forms the basis of science. To borrow a telling phrase from Roosevelt, sciosophy is science's "lunatic fringe."

I once walked in a garden with a wise little girl to whom I told Riley's story of "the goblins that get you if you don't watch out." She was not particularly impressed and she said, "There isn't any such a thing as a goblin and there isn't ever going to be any." In the spirit of philosophic doubt possessed by Berkeley and affected by Balfour, I answered, "Maybe there isn't any such a thing as anything." "Yes, there is," and she looked about the garden for unquestioned reality, "yes, there is such a thing as anything; there is such a thing as a squash."

And in this conclusion of the little girl the reality of the objective world, the integrity of science and sanity of man are alike bound up. The distinction between objective and subjective, between reality and illusion, between fact and dream, between presence and memory, between reason and tradition, all fundamental in human psychology, each is essential in human conduct. Truth is livable and error is not, a difference which appears in the stress of the conduct of life.

Men and animals are guided by their realities. They live by truth. Instinct points the way ancestors have safely trodden. Intellect is the power to choose new conditions, new responses to the demands of new environment. Of the hosts of men and animals and plants now living on the earth, not one had an ancestor who died in infancy. That they have each and all passed that period at least shows that they have had safe guidance with capacity to size up the situation with substantial accuracy so far as they were themselves concerned. Were it not for this faculty the race of men could never have

maintained itself. The sense organs of every animal are so constructed that the realities they grasp are adequate for their inherited needs. For truth in dealing with external things is not primarily understanding of the things themselves but rather of their relation to us.

The power to summon up adequate truth from our realities is called common sense. Science is only common sense expanded and verified and applied to a wider range of objects. With its instruments of precision (mind, memory, logic, mathematics, and its accessory tools) it goes beyond the obvious into the hidden complexities of truth. The final test of truth is its "livableness," the degree to which we may trust our lives to it or to the methods by which it is won. It is not merely "workableness," for an idea false or incomplete may be workable in a degree. Many elements of sciosophy are workable, if not put to an acid test. That one man or ten million men get along with an idea or a dogma does not argue its soundness, unless these men have successfully translated it into action.

The purpose of science is in the main threefold: first, to help humanity by its control of sanitation, conservation, and the use of the forces of nature—this is applied science; second to furnish a sound basis for the conduct of life—this is the art of ethics, and right living can fall back on no other authority. We may not trust to impulse or instincts, for the power to control and to discriminate among these is the function of intelligence. We can not trust to religion, for the sentiment of fear, awe, reverence and duty is sadly bound up with superstition. Superstition is believing or trying to believe what we know is not true. It is for science to combat superstition and to disentangle religion from its meshes.

The third function of science is to widen the human mind. Its span is the universe, dealing as well as may be with the infinite great as with the infinite little. We can reach a small part, not a fraction but a tangible fringe of a universe in which there is neither great nor small. We find in it endless change, but every change is orderly. So far as we can see "nothing endures save the flow of force and the rational intelligence that pervades it." This intelligence we can not describe, nor circumscribe. We can not speak of it in any terms of human experience, and to try to do so shows only the narrowness of our conception. These words are attributed to Mencius in China thirty centuries ago. "He will appear without showing Himself, effect renovation without moving, create perfection without acting. It is the law of heaven and earth whose way is solid, substantial, vast and unchanging."

DAVID STARR JORDAN

STANFORD UNIVERSITY

MEDICAL EDUCATION AND CULTURE[1]

IN a recent discussion of medical education there occurred the phrase, "This culture business." It is a challenge in its implied scorn. It questions the intimacy of relationship between education and so-called culture and suggests that the more widely they are separated the better it is for education. As to real culture, that comes only from a scientific study of man and the world around him.

In view of what William James called "the fluidity of the facts," it may be worth while to accept the challenge, or at least to think about accepting it.

What have men of science to do with culture, and what is culture to them? Not only of men of science, to whom the method of science is as the breath of their nostrils, but of doctors, teachers, there is asked the question, "What has culture to do with education?"

No attempt will be made to give a new definition of culture, nor to catalogue what others have said about it, but the words of Whitehead are both apt and beautiful. In his presidential address to the British Mathematical Association on the "Aims of Education," he says, "Culture is activity of thought and receptiveness to beauty and humane feeling."

Now culture may be looked upon from two points of view. It may be regarded as the end-product, the result of endeavor; or it may be regarded as the process, which, in so far as process determines result, determines what is to be attained. It is to culture as a process that consideration will now be given.

In moments of depression, one may feel as if some of the present-day methods of teaching are like feeding the dog. The dog is given a bone, in the form of a lecture to the student. If, later, the disfigured bone is recovered with some inconvenience and perhaps risk, the lecturer has in the examination paper a scarcely recognizable fragment of what he intended to convey to the mind of the pupil.

But the mind of the pupil should be fertile. Ideas thrown into it should germinate, grow and bear fruit. The seed should fall on good ground, ground that has been well prepared. It is true that in a general scheme of education the rocky ground and the shallow soil have to be considered. But by the end of two years of college work, the present minimum requirement for admission to the medical school, the processes of selection may be expected to eliminate most of the candidates who are naturally unfit. If the processes of selection are just, and they need careful revision from time to time, and the educational

[1] Read at the meeting of the Council on Medical Education of the American Medical Association in Chicago, March 3, 1924.

processes are adequate, the students who are admitted to the medical school may be regarded as the desired good ground.

At this point, a question may be raised. Is the seed good? Is there not much chaff? This is a serious problem to which at some time there will have to be given careful attention. If the seed is good, is it of the right kind? For example, there is confusion of purpose in the medical curriculum as it is now arranged. The teaching of anatomy furnishes an illustration. Formerly anatomy was taught chiefly by surgeons. Recently it has passed more and more into the hands of men whose major interest is in human and comparative anatomy, histology, embryology and closely related branches of biology. As a result, these sciences have grown rapidly and cover a wide field in which the interest of the medical student is limited. At present the physician in training devotes time and attention to too much anatomy outside of what is needed in the practice of medicine; but already there is a movement to correct this misplaced emphasis.

Culture, then, may be regarded as the process which produces in the pupil, the student, a condition of fertility of mind, of richness of imagination, in so far as this is produced or affected by conditions external to the individual himself.

There is no question that fertility of mind is needed, not alone in medicine, but in every walk of life. Men of great, controlled, disciplined imagination are sought everywhere. Thomas Edison complains that he can not get men of imagination in his business; and Henri Poincaré, in his discussion of the part that hypothesis plays in science, has indicated the rôle of the imagination in the most majestic of sciences, mathematics.

What is the relation of culture to education? It is appropriate to use almost the exact words of John Henry Newman, who, after the manner of the Schoolmen, distinguishes between the integrity and the essence of the university, and reply that while the integrity of education consists in discipline, its very essence is culture.

How can medicine be taught culturally? In the best sense, it can not be taught in any other way. If the human mind is brought in contact with things intellectual, it is nourished by them, it grows and bears fruit. It is this basic fact that determines the method. As President Gilman said, "Every study is liberal, if it is pursued in a liberal spirit."

Again the teaching of anatomy furnishes a convenient illustration, for it is acknowledged to be fundamental and the principles involved are identical for all the sciences.

How can anatomy be taught culturally, so that it shall be to the student a source of inspiration, of power; as Keyser has so well put it, wooing his loyalty, revealing to him the guardian angel of science, that ideal of excellence, with the abiding sense of the authority of its standards?

In the first place, anatomy should be taught as it is. But what is it? It is a living, growing science, with a history, an evolution not yet completed; with a past, a present and a future; comprising problems that have been solved, problems now in solution, problems that await solution, perhaps only at some distant day.

Too much is attention directed to text-books, of which Minot said, "When knowledge is dead, we bury it decently in a book"; and to mechanisms which, worn out and exhausted, would be thrown away if it were not for the dissecting room. And of course investigation is necessary. Anatomy can best be taught as a living, growing branch of knowledge by one under whose hands it grows.

In addition to this evolutionary or historical point of view, there is the biographical point of view. The problems of anatomy are problems to persons. The stories of the lives of the men who formulated, attacked and solved the problems are among the stimulating influences of our lives. They open wide vistas to the eyes of the student.

John Hunter is an example; anatomist, physiologist, pathologist, surgeon and above all experimental biologist. "Don't think; try," was his dictum. It might well be said all living things were his province. At a time when he was struggling against the disease which later proved fatal, in a letter to a friend in Africa, asking for many things, he wrote: "If a Foal Camell was put in a tub of spirits and sent, I should be glad. Is it possible to get a young tame lion, or indeed any other beast or bird?" *Or indeed any other beast or bird!* How can one read the story of Hunter's life and not be uplifted by the picture of his marvelous and vehement energy?

The third point involves a paradox. It is that if anatomy is to be studied culturally, it can not be studied by itself. For culture implies interpretation and significance and values; relation to other things and to other branches of knowledge. In the medical curriculum, this means at least correlation of courses; the relation of anatomy to physiology and to pathology and to clinical medicine; the relation of structure to function, whether in the gross or in the ultramicroscopical molecule or atom. But it is not enough to concede that correlation is advantageous. Correlation is more than advantageous, it is vital in teaching.

Professor Whitehead puts the whole matter briefly. He says, "Theoretical ideas should always find important applications within the pupil's curriculum. This is not an easy doctrine to apply but a very hard one. It contains within itself the problem of keeping knowl-

edge alive, of preventing it from becoming inert, which is the central problem of all education."

STEPHEN RUSHMORE

BOSTON, MASSACHUSETTS

SCIENTIFIC EVENTS

RESOLUTIONS ON THE DEATH OF DEAN CONANT WORCESTER

MR. DEAN CONANT WORCESTER, first secretary of the interior of the Philippine Islands and the man responsible for the founding of the Bureau of Science, the Philippine General Hospital and the College of Medicine, Manila, died in Manila on May 2, 1924. Before going to the Philippines Mr. Worcester was assistant professor of zoology and curator of the museum at the University of Michigan. In view of his contributions to science, representatives of the Philippine General Hospital, the College of Medicine and the Bureau of Science met and passed the following resolutions:

WHEREAS, It has pleased Almighty God in His wise and inscrutable Providence to remove from among us Dean Conant Worcester;

WHEREAS, At best we can do little at this time to indicate our real appreciation of him as a man and as a worker for the best medical and other scientific interests of the Philippine Islands; and

WHEREAS, It was largely through his efforts, as Secretary of the Interior of the Government of the Philippine Islands, that the Philippine General Hospital, the Bureau of Science and the College of Medicine were established, Therefore be it

Resolved, That we, members of the Philippine General Hospital, Bureau of Science and College of Medicine, of Manila, Philippine Islands, do hereby express our deepest sorrow for the death of Dean Conant Worcester; and, be it further

Resolved, That he holds a place of highest respect, admiration, and appreciation in the hearts of all of us because of the great good that he did as Secretary of the Interior in organizing the Philippine General Hospital, the Bureau of Science and the College of Medicine; and, be it further

Resolved, That we extend our sincerest sympathy and condolence to his widow, son, daughter and other relatives; and, be it further

Resolved, That these resolutions be engrossed and sent to his widow, and that copies be filed in the archives of the Philippine General Hospital, the Bureau of Science and the College of Medicine, published in the newspapers of Manila, in the *Philippine Journal of Science*, in the *Journal* of the Philippine Islands Medical Association, and in SCIENCE, the official organ of the American Association for the Advancement of Science, of which he was a member.

For the staff of the Philippine General Hospital: Fernando Calderon, Jose Albert, J. I. Abuel, F. E. Jayme.

For the staff of the Bureau of Science: Wm. H. Brown, Leon Ma. Guerrero, R. C. McGregor, G. M. De Ubago.

For the staff of the College of Medicine: Fernando Calderon, Liborio Gomez, Arturo Garcia, D. de la Paz, Jose Albert.

At Manila, Philippine Islands, this fifth day of May in the Year of our Lord One Thousand Nine Hundred Twenty-four.

FOREST SERVICE RESEARCH CONFERENCE

A CONFERENCE of great importance and promise to the cause of better forestry in the United States was recently concluded at Madison, Wisconsin. There the federal research workers in forestry gathered from all the Forest Service Districts and Experiment Stations throughout the country and discussed their problems, methods, results and proposed projects for a period of two weeks. Meeting with the research men were also several of the administrative men from the National Forest Districts. In this way the scientific findings of the research men were discussed in the light of practical experience by those whose chief function is to make application of research results.

Three general subjects were considered in all their detailed ramifications, namely:

(1) Research results in the study of forest fires, their control, prevention and prediction;

(2) The technique of measuring and estimating the growth and yield of timber of various types under the widely varying forest conditions in the different sections of the country;

(3) The standards of forest practice for the various regions which are necessary to keep forest lands productive. This subject was considered from two standpoints, representing different levels of attainment.

(a) The minimum requirements in forest practice which are necessary to prevent forest devastation. By their very nature these requirements represent the least that should be expected of all timberland owners.

(b) Desirable forestry practice, a standard now prevailing on the National Forests because of their being under the control of the Forest Service. This is a standard which should eventually prevail on private forest lands as well.

To the workers in other branches of science who may consider forest fires as accidental disasters of spasmodic occurrence whose prediction is beyond the wisdom of man, it will be decidedly illuminating and interesting to look into the laboratories of the Forest Experiment Stations and note the methods used in studying fire phenomena. Even in the case of forest fires caused by lightning (and there were 2,323 such in 1922 on the National Forests alone—practically one third of the number of fires started on the National Forests in that year) the Forest Service research workers are ruthlessly prying into the secrets mother Nature has heretofore hidden away in her pri-

vate boudoir. They hold that Benjamin Franklin established a worthy precedent for this intrusion.

The lines of attack for the forest fire prediction studies are advancing along five different routes to the same objective. These are, (1) relative humidity, (2) moisture content of the inflammable material, (3) evaporation studies, (4) vapor pressure, and (5) statistical data. In all cases the work is correlated with meteorological records and forecasts and is done in close cooperation with the Weather Bureau. These studies have an immediately practical value in the warnings issued and measures taken to increase the vigilance of both public and private forces against forest fires during those periods shown by the research workers to be of greater fire hazard than usual. The ultimate object sought, of course, is greater control of all forest fires in the country which are each year sweeping over an area about one fourth that of the entire State of New York.

Both popular and scientific interest is concerned with the ratio between the diminishing supply of our timber and the growth of new wood to replace it. This relationship has been emphasized many times. Usually it is thought of in terms of the welfare of future generations. In recent years, however, the fact has been forced to our attention that even now the people of the United States are in the midst of a serious timber famine when lumber prices and availability of material are considered.

To secure definite and accurate data on this question of timber supply, the Forest Service through both its research and administrative divisions is earnestly engaged. Detailed studies have been undertaken and are being conducted as comprehensively as is possible with the present field force to ascertain the rate of growth of the various species of forest trees under the conditions prevailing in the widely different sections and to measure the annual production and total available yield on the forested areas.

Closely connected with the taking of this inventory, so to speak, is the big subject of proper forest management by which the utilization of our present timber resources and the constant replenishment of the same will go hand in hand. This involves putting into effect as rapidly as possible on both public and private forests those practices that will accomplish this two-fold purpose. These practices will be based upon the findings of the investigational work in forestry that has been carried on for nearly two decades.

This research conference of the Forest Service might well be considered an important milestone of progress along the highway leading to a full understanding of forestry problems and methods of solution.

M. C. MERRILL

WASHINGTON, D. C.

THE SECTION OF ZOOLOGY OF THE BRITISH ASSOCIATION

OVERSEA members of the British Association for the Advancement of Science coming to the Toronto meeting, beginning August 6, include the following:

Vice-president of Section D.—J. H. Ashworth, D.Sc., F.R.S., professor of zoology, University of Edinburgh.

Recorder—F. Balfour Brown, M.A., F.R.S., F.Z.S., Cambridge.

Secretary—W. J. Dakin, D.Sc., F.L.S., F.Z.S., professor of zoology, University of Liverpool, will speak on "Respiration in fishes" and "Putterism."

Miss Kathleen E. Carpenter will speak on effect on river fisheries of pollution caused by lead mining and on the biological factors involved in the distribution of river fisheries by pollution consequent on lead poisoning.

F. A. E. Crew, D.Sc., department of animal breeding research, University of Edinburgh.

J. T. Cunningham, M.A., F.Z.S., lecturer in zoology, University of London, will speak on the Lamarckian theory of the evolution of the secondary sexual characters.

D. Ward Cutler, cytologist from the Rothamsted experimental station, will lecture on soil population.

F. A. Dixey, M.A., M.D., F.R.S., bursar and lecturer of Wadham College, Oxford, will speak on scent distributary apparatus in lepidoptera.

R. R. Gates, Ph.D., F.L.S., professor of botany, University of London, formerly acting associate professor of zoology, University of California, 1915–16.

E. S. Goodrich, M.A., F.L.S., F.R.S., Linacre professor of zoology and comparative anatomy, University Museum, Oxford, discusses "The origin of vertebrates."

Mrs. Pixell Goodrich, D.Sc., will deliver a paper on "Parasitic diseases of Gammarus."

J. W. H. Harrison, zoology department, Armstrong College, Newcastle, will speak on "Inheritance of hybrids between British and Canadian lepidoptera."

Sir William A. Herdman, C.B.E., D.Sc., LL.D., F.L.S., F.R.S., late professor of oceanography, University of Liverpool.

L. Hogben, D.Sc., will speak on "Hormones of the pituitary body."

Julian Huxley, senior demonstrator in zoology, Oxford, four years assistant professor in Rice Institute, Houston, Texas, will speak on "Ductless glands in relation to amphibian metamorphosis" and on "Chromosomes and species."

C. H. Osterfeld, head of the plankton section of the bureau of the Conseil Internationale pour l'Explorations de la Mer, Copenhagen.

A. D. Peacock, lecturer in zoology, Armstrong College, Newcastle-on-Tyne, will discuss "Sex change experiments in saw flies."

F. A. Potts, M.A., zoologist, Trinity College, Cambridge, will speak on "Intracellular digestion in invertebrates."

W. M. Tattersall, D.Sc., professor of zoology in the University College of South Wales, Cardiff.

D'Arcy Wentworth Thompson, C.B., D.Litt., F.R.S., professor of natural history, St. Andrew's University, scientific member of fishery board for Scotland, British delegate on Behring Sea and North Sea conferences.

Henry William Marett Tims, O.B.E., M.D., reader in zoology in Bedford College, London, lecturer on comparative dental anatomy and physiology in the Royal Dental Hospital, London.

D. M. S. Watson, M.Sc., F.R.S., professor of zoology and comparative anatomy, University College, London, will speak on paleontology and Mendelism, and discuss "The origin of vertebrates."

R. Ramsay Wright, LL.D., emeritus professor of biology, Toronto University, previously of Edinburgh University and vice-president of the University of Toronto, 1901–12.

THE AMERICAN MEDICAL ASSOCIATION

THE seventy-fifth annual session of the American Medical Association was opened in Chicago, on June 9, when the house of delegates met. The scientific assembly held a general meeting on the evening of June 10, when Dr. William Allen Pusey, of Chicago, was installed as president and delivered an address. The sections, of which there are sixteen, met on the three following days. A series of clinics were held and daily demonstrations given of fresh pathological material, both human and animal, and also a special demonstration of modern methods of studying the heart; the New York association for the prevention and relief of heart disease arranged an exhibition illustrative of its work. Various other associations took the opportunity of showing their methods of work; among them were included the League of Nations, the American Association of Hospital Social Workers, the American Social Hygiene Association, and the Medical Women's National Association. The United States Department of Agriculture arranged a special Pasteur exhibit illustrating his work on chicken-cholera, anthrax and rabies. Various departments of the American Medical Association gave exhibits, including the council on pharmacy and chemistry, the propaganda department of the *Journal of the American Medical Association,* the council on medical education and hospitals, and the bureau of health and public instruction. All the meetings and demonstrations took place in the buildings on the Municipal Pier, where there is a motion picture theater, which was used to show a number of scientific films. In addition a large number of pathological specimens were shown by various individuals and institutions, the latter including the Mayo Clinic, the department of pathology of the Rush Medical College, Chicago, and the medical schools of the University of Illinois and Kansas. A special feature was a collection of various models and appliances for the teaching of pathology and clinical medicine and surgery. The commercial exhibition was on a large scale, and among the objects shown were books, foods and beverages for adults and infants, instruments and apparatus, pharmaceutical preparations and apparatus for treatment by X-rays and electricity.

SCIENTIFIC NOTES AND NEWS

AT Harvard University the doctorate of science has been conferred on Edmund B. Wilson, of Columbia University, and on Dr. W. J. Mayo, of Rochester, Minn.

QUEEN'S UNIVERSITY, Ontario, has conferred the degree of doctor of laws on S. A. Mitchell, professor of astronomy at the University of Virginia and director of the Leander McCormick Observatory, on account of his "international eminence as an astronomer."

AT a special congregation on July 5, the University of Birmingham, England, will confer the honorary degree of LL.D. upon Sir Charles Sherrington, president of the Royal Society, Sir John Bland-Sutton, president of the Royal College of Surgeons of England, Sir Arthur Keith, Hunterian professor at the Royal College of Surgeons of England, Dr. F. Gowland Hopkins, Sir William Dunn, professor of biochemistry in the University of Cambridge.

DR. THOMUS HUNT MORGAN, professor of zoology at Columbia University, has received the honorary degree of LL.D. from the University of Michigan.

AT the sixty-eighth annual commencement of Tufts College, held on June 16, the honorary degree of doctor of science was conferred on Edward Ray Weidlein, director of the Mellon Institute of Industrial Research of the University of Pittsburgh.

THE UNIVERSITY OF MARYLAND at its commencement exercises conferred the honorary degree of doctor of pharmacy on Dr. David I. Macht, lecturer in pharmacology at the Johns Hopkins University, in recognition of his contributions to pharmacology and experimental therapeutics.

EMIL BOREL, professor of mathematical physics at the University of Paris, will represent the Association Française pour l'Avancement des Sciences at the Toronto meeting of the British Association in August.

DR. WILLIAM M. WHEELER, professor of entomology and dean of the faculty of the Bussey Institution at Harvard University, has been named to represent the university as exchange professor in France during the second half of the next college year.

DR. THEODORE LYMAN, Hollis professor of mathematics and natural philosophy and director of the

Jefferson physical laboratory at Harvard University, has been elected president of the American Academy of Arts and Sciences.

The Linnean Society has conferred its gold medal on Professor W. C. M'Intosh, F.R.S., late director of the University Museum and the Gatty Marine Laboratory at St. Andrews.

A dinner in honor of Dr. Claude Regaud, director of the Radium Institute, Paris, was given on June 19, at the Hotel Commodore by the New York Roentgen Society.

William Gaertner, president of the Gaertner Scientific Corporation, Chicago, has been awarded the Howard N. Potts Gold Medal by the Franklin Institute, "in consideration of his notable achievement as a designer and maker of scientific instruments, materially contributing to the success of the research in physical science."

Dr. Walter G. Bain, Springfield, was elected president of the Illinois State Academy of Science, at the annual meeting, held recently at Elgin.

Dr. Eugene A. Crockett, of Boston, has been chosen president of the American Otological Society at its fifty-seventh annual meeting.

Dr. Erich Hausmann, Thomas Potts professor of physics and professor of electrical communication at the Polytechnic Institute of Brooklyn, was elected president of the New York Electrical Society at the annual meeting held on June 5. William S. Murray, Samuel G. Rhodes and Arthur E. Allen were elected vice-presidents, David Darlington treasurer, and Mr. Henry E. Farrer secretary.

Dr. Arthur W. Gilbert, professor of plant breeding at Cornell University, was appointed by the Secretary of State to head the American delegation to the meeting of the general assembly of the Institute of Agriculture, which was held in Rome.

Dr. William Campbell has been appointed first Howe professor of metallurgy at Columbia University. The trustees created the new chair in honor of the distinguished service of the late Henry Marion Howe, professor of metallurgy from 1897 to 1913, and president in 1893 of the American Institute of Mining and Metallurgical Engineers.

Dr. Campbell P. Howard, for fourteen years head of the department of theory and practice at the University of Iowa, has resigned to accept the position of professor of medicine at McGill University, Toronto, Canada, and physician to the Montreal General Hospital.

Te Rangi Hiroa (Dr. P. H. Buck), director of Maori Hygiene, Auckland, has been appointed associate in anthropology on the staff of Bernice P. Bishop Museum, Honolulu. He is sub-editor of the *Polynesian Journal*, a member of the board of Maori Ethnological Research and external examiner in anthropology to the University of New Zealand.

Professor Raymond Pearl, of Johns Hopkins University, gave a lecture at University College, London, on June 24, on some recent experimental and statistical studies on the alcohol problem.

The Croonian lectures at the Royal College of Physicians of London were given this month, beginning on June 17, by Sir Leonard Rogers, M.D., F.R.S., whose subject was researches on leprosy and their bearing on the treatment of tuberculosis.

Grenville A. J. Cole, F.R.S., has died at the age of 75 years. He held the professorship of geology in the Royal College of Science for Ireland from 1890 until his death, and was dean of the college for two years. In 1905 he became director of the Geological Survey of Ireland.

Dr. Edwin E. Sparks, former president of the Pennsylvania State College, died suddenly on June 15 from a heart attack.

Frank B. Gilbreth, well-known mechanical engineer and authority on industrial efficiency, died on June 14, aged fifty-six years.

Dr. Johan Nordal Fischer Wille, professor of botany in the University of Christiania, Norway, has died at the age of sixty-six years.

Dr. Forbes Fraser, Surgeon, Royal United Hospital, Bath, who was to have been president of the British Medical Association at its annual meeting next year, died on May 28.

A course of lectures on psychology has been established at Clark University, made possible through the generosity of Dr. E. E. Powell, of Miami University, Ohio. Three of the lecturers will be Dr. Knight Dunlap, of Johns Hopkins; Dr. E. B. Titchener, of Cornell, and Dr. John B. Watson, of New York.

The annual meeting of the Society of Chemical Industry of England will be held in Liverpool, July 9 to 12. Headquarters for the meeting will be at Midland Adelphi Hotel, Liverpool. The program includes an informal reception by the president, E. Frankland Armstrong, and the local committee at the headquarters hotel; a general meeting including presidential address on "A neglected chapter in organic chemistry: the fats," and the Messel memorial lecture and award of the Messel medal for 1924 to Rt. Hon. Viscount Leverhulme.

We learn from *Nature* that the hundred and fifth annual meeting of the Swiss Society of Natural Sci-

ences will be held on October 1 to 4, at Lucerne, under the presidency of Professor H. Bachmann. Professor Bachmann's presidential address will be delivered on October 2, and the morning sessions of the two succeeding days will be given over to the scientific work of the seventeen sections into which the congress will be divided. On October 4, addresses will be given by L. Michaud, professor of clinical medicine in the University of Lausanne, on the rôle of colloids in medicine, by Dr. F. W. Aston, on atoms and isotopes, and by Professor A. Einstein, on recent changes in the fundamentals of mechanics. Excursions have been arranged to places of anthropological, hydrobiological, zoological, and engineering interest in the neighborhood.

THE Western Society of Engineers has conferred upon Arthur N. Talbot, professor of municipal and sanitary engineering at the University of Illinois, its annual reward upon "the engineer who has done the most to promote the happiness and welfare of humanity." B. T. Hawson, western editor of the *Railway Age,* was elected president of the society for the coming year.

DR. LOUISA MARTINDALE, of London, president-elect of the British Women's Medical Association, and Dr. Claude Regaud, of Paris, director of the radium institute of Mme. Curie at the University of Paris and professor at the Pasteur Institute, were guests of the American Medical Association at its convention in Chicago.

ALUMNI members of the University of Texas have pledged $250,000 to that institution to be used for 250 research fellowships in the graduate department. Each year for five years fifty fellowships of $1,000 each will be available to college graduates of the United States.

THE Mining and Geological Institute of India has awarded its gold medal for 1923 and the Government of India prize of rupees 500 to Mr. Lancaster D. Burling for a paper on "The origin of petroleum," presented to the institute during his stay in India as a geologist for the Whitehall Petroleum Corporation.

AWARD of prizes offered by the American Institute of Electrical Engineers for papers written by its members has been approved as follows: The transmission prize went to the paper on "High-voltage insulation," by J. L. R. Hayden and the late Charles P. Steinmetz, with honorable mention to Howard S. Phelps and E. Dean Tanger for their paper on "A new method for routine testing of alternating current high-voltage paper-insulated cable," and also to F. S. Dellenbaugh, Jr., for his paper on "Artificial transmission lines with distributed constants."

THE London County Council has announced the establishment of two fellowships to be known as the Robert Blair fellowships in applied science and technology. These fellowships, of which two will be awarded each year, carry a monetary grant of £450 each. Applicants must be British subjects, at least 21 years of age, preference being given to students of engineering science, and to those who have completed a course of study in London institutions, or have been identified with the London teaching service.

ACCORDING to the London *Times,* a lake-dwelling of the Bronze Age has been discovered on the Lake of Thun, Switzerland, and investigations will be made when the waters are lower. This is the first lake-dwelling to be discovered in the Bernese Oberland.

IN response to the request of the New Zealand board of science and art, arrangements have been made for the accommodation of "approved New Zealand scientists" on H. M. S. "Veronica" and H. M. S. "Laburnum" on cruises beginning early in June and ending in October. Special opportunity will be given for visiting the smaller islands in the vicinity of Rarotonga and Apia.

THE Rockefeller Foundation is supplying Germany with six copies each of four hundred British and American medical periodicals. Two copies will be kept in the libraries of Berlin and Munich, while the other four will be circulated throughout the various German universities, which will be divided for this purpose into four groups.

THE following appointments to fellowships and scholarships in chemistry have been made at Yale University for the year 1924–25: Floyd S. Daft, Cheney Silk Fellowship; Roger E. Blackburn, Du Pont Fellowship; Alice G. Renfrew, Cutler Fellowship; Evald L. Skau, Sterling Fellowship; Theodore K. Cleveland, University Fellowship; Lorenz P. Hansen, University Fellowship; Charles L. Lazzell, University Fellowship; Geneva Leopold, University Fellowship; Marion C. Pfund, University Fellowship; Elliott R. Weyer, Sterling Scholarship.

BENJAMINITE is a new argentiferous sulphobismuthite of lead and copper differing in ratios from any known mineral, which Earl V. Shannon has recently described in the proceedings of the U. S. National Museum. This new mineral was found in a quartz vein with molybdenite, mica and minor amounts of other minerals, near Round Mountain, Nye County, Nevada. It has been named in honor of Dr. Marcus Benjamin.

A CAMPAIGN to wipe out trachoma, an eye disease which has been epidemic among Indians, will be started July 1 by the Indian office and the Public Health Service. Plans for the crusade call for opera-

tions first in Arizona and New Mexico, which later will be extended to all Indian reservations. Temporary hospitals will be established in Indian school buildings unoccupied during the vacation period.

FORESTRY investigations in the southern pine belt will be greatly enlarged by the increased appropriation of $25,000 for the Southern Forest Experiment Station made in the closing days of the past session of Congress. The increased appropriation will permit adding several men to the station staff and increasing the investigations now under way on forest fires, reforestation, methods of cutting timber to insure natural reforestation, better methods of turpentining to prevent killing timber, damage caused by grazing, rate of growth of timber and many problems connected with timber growing throughout the pine region.

THE Geographical Society of Geneva, acting on behalf of the International Red Cross Committee and of the League of Red Cross Societies, has decided to issue a scientific periodical entitled "Matériaux pour l'étude des calamités" (Contributions to the study of calamities). It will publish original articles, reviews of important publications dealing with particular chapters of geophysics (earthquakes, volcanoes, etc.), meteorology (cyclones, blizzards, floods, droughts, etc.), zoology (locusts), hygiene (epidemics, famines), reviews of important publications, recent information and data.

THE ninth report of the British committee for the investigation of atmospheric pollution, covering the year ended March 31, 1923, has been issued. The year's operations are described under six sections. The first deals with the results obtained by what is known as the standard deposit gauge, in which atmospheric impurity accumulates month by month with the rain. Thirty-five such gauges were in operation during the year. It is shown that there was a distinct improvement in the purity of the air during the year as compared with the average of preceding years. A table is given showing the places with the highest and lowest deposits for the year. The highest total deposits is shown in Rochdale and the lowest in Rothamsted; the greatest amount of tar was deposited in Newcastle-on-Tyne, while the highest deposit of sulphates was found in Southwark Park, London.

FRENCH chemists have perfected new methods of identifying pictures, according to the American Chemical Society. They use groups of red, blue, green, or white light to light the picture, and they examine the suspected canvass with the spectrometer. Employment of these various colors puts in relief the retouchings, scrapings and changed signatures which constitute a false picture. By employing the ultraviolet ray they make the zinc white and certain varnishes stand out by fluorescence. Finally, by scraping off very small amounts of paint, they have made spectrographic analyses of them, and have been able thus to determine for example, in a false Renoir, the presence of a cadmium yellow, when Renoir only used chrome yellow.

UNIVERSITY AND EDUCATIONAL NOTES

WELLESLEY COLLEGE has received $500,000 for a new administration building by the gift of Colonel and Mrs. Edward H. R. Green, of New York.

A GIFT of $500,000 has been made by John D. Rockefeller, Jr., to the division of fine arts of Harvard University to be applied to the fund of $2,000,000 being raised for the erection and endowment of the new Fogg Art Museum at the university.

HERBERT E. BOLTON, professor of history at the University of California for the past twelve years, has been appointed president of the University of Texas.

DR. LEROY A. HOWLAND has been reappointed acting president of Wesleyan University.

DR. A. C. SEWARD, F.R.S., master of Downing College, and professor of botany, has been elected Vice-Chancellor of Cambridge University for the academic year beginning October 1 in succession to Dr. E. C. Pearce, master of Corpus Christi, who will have served the office for three years.

DR. WILBERT C. DAVISON, associate professor of pediatrics, Johns Hopkins Medical School, has been named assistant dean in that institution.

DR. R. F. RUTTAN, director of the department of chemistry, McGill University, has been appointed dean of the faculty of graduate studies and research, to succeed Dr. F. D. Adams, who has resigned from the university.

HERBERT S. LANGFELD, professor of psychology at Harvard University, has been appointed professor of psychology and director of the new psychological laboratory at Princeton University.

PROFESSOR E. R. HEDRICK, of the University of Missouri, has been appointed professor of mathematics at the University of California and will be in charge of the department of mathematics at the southern branch, Los Angeles.

APPOINTMENTS made at the University of Oklahoma include that of Dr. A. O. Weese, of James Milliken University, who has been made professor of zoology, and A. I. Ortonburger, of the American Mu-

seum of Natural History, assistant professor of zoology.

TWO appointments from European universities to the faculty of the medical school of Johns Hopkins University have been made as follows: Dr. J. W. McNee, of University College, London, is to be associate professor of medicine. Dr. Bela Halpert, first assistant to Professor Otto Grosser at the University of Prague, is to be instructor in anatomy.

DR. ROBERT C. MILLER, who during the past three years has been engaged in the marine borer investigations of the San Francisco Bay Marine Piling Committee and the National Research Council, has been appointed assistant professor of zoology in the University of Washington.

THE following appointments have been made at the University of Virginia: Dr. Leroy A. Calkins, of the University of Minnesota, to professor of obstetrics and gynecology; Dr. Alfred Chanutin, of the University of Illinois, associate professor of biological chemistry; Dr. Arthur Ferguson Benton, national research fellow at the California Institute of Technology, to assistant professor of chemistry, and Dr. A. A. Pegan to acting assistant professor of geology.

DISCUSSION AND CORRESPONDENCE

WOMEN OFFICERS OF THE ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

IN the third article on "The history of the A. A. A. S." by Professor Herman L. Fairchild, in SCIENCE, for May 9, p. 411, it is said that: "The only woman official of the association was Mrs. Erminnie A. Smith, who was secretary of the section of anthropology in 1885." This is incorrect, as there have been at least three other women officials, all of the section of anthropology. Two were chairmen of that section, *viz.*, Miss Alice C. Fletcher at the Buffalo meeting of 1896 and Miss Lillian J. Martin in 1915. In 1894 I was elected secretary of the section for the following meeting, but resigned before it was held. The secretary who had been elected for the 1897 Detroit meeting similarly resigned, and I was then elected for the second time and served as secretary at that meeting.

There was an odd combination of circumstances at Detroit in 1897. The president of the association did not attend the meeting; my husband, W J McGee, was chairman of anthropology and senior vice-president of the association; his time was therefore mainly occupied by his duties as acting president, while I became acting chairman, as well as secretary, of the section.

ANITA NEWCOMB MCGEE
WOODS HOLE, MASSACHUSETTS

POISONING FROM CASTOR BEANS

I HAVE been much interested in the recent letters regarding allergic reactions with castor beans. The castor bean grows wild here over wide areas and is commonly eaten by many people as a substitute for the oil or a pill for a cathartic. This practice is so common that it is currently believed that the beans are innocuous, but there is ample evidence to the contrary.

In 1920 a soldier stationed in Schofield Barracks ate five castor beans one afternoon. The morning of the second day he died in coma, the direct cause of death being acute nephritis. He had anaphylactic symptoms within a few hours after ingestion of the beans, followed by an intense toxemia which was fatal through kidney damage. This was considered at the time to be due in all probability to a ricin poisoning, which may have been absorbed through the mucous membrane of the alimentary canal, or possibly, and I think more likely, through a lesion somewhere in the canal.

I have since seen two cases where the ingestion of a single bean was followed in five minutes by edema of the mouth and pharynx and in one case of the glottis. This progressed in each case to a degree which made speech or swallowing extremely difficult, and in one case respiration became dangerously impeded. In each case there was general urticaria with giant wheals. Adrenalin relieved all the symptoms promptly and permanently.

The asthmatic and hay-fever symptoms mentioned in previous communications are entirely new in my experience, and it would interest me greatly to hear whether any one else has experienced them.

H. L. ARNOLD
HONOLULU, HAWAII

THE ENCYSTMENT OF VAMPYRELLA ELEGANS (H. AND L.)

AN interesting analysis of the conditions leading to encystment of *Didinium nasutum*, by Mast and Ibara, appeared in *Biological Bulletin* last August. In their introduction, they cited the opinion of Root that suctoria encyst when they lack food; of Mast that Didinium sometimes encysts when food is lacking; of Miss Carter that Amoeba encysts when food is abundant; of Miss Hogue that Amoeba limax encysts due to metabolic waste products, which lead to a weakened vitality, "resulting in the loss of power of assimilation"; and of Calkins, who, in speaking of encystment in general, says it is "a special adaptive process by which the organisms are enabled to survive when the environment is unsuitable."

In this connection, facts concerning the *Vampyrella elegans* (H. and L.) that appeared under the title

"Notes on Leptophrys,"[1] are of interest and should be made more available.

In this paper it is recorded that "some time after the animal has gorged itself with food, or formed a central, common vacuole of food, it withdraws its pseudopodia and enters into an encysted condition. Numerous cysts have been seen and studied. A single individual has been observed ingesting food and was followed through its complete encystment. From the time when the animal had quieted down and ceased to ingest food to when it left the cyst, a period of five hours had elapsed. The cyst varies in size and shape, depending upon the size of the animal and the amount and form of the food."

Again, in 1908,[2] it was recorded that when Vampyrella ingests food, "the protoplasm forms a rounded mass about which an encysting membrane is formed. The animal remains quiet while the food is being digested. As digestion proceeds, the plants taken in as food change from green to brownish red. The food decreases in size as its digested parts are absorbed from the food vacuole. The protoplasm becomes pigmented by the assimilated food, so that when the protoplasm breaks from the cyst as a free animal or animals, it is conspicuously colored brownish red."

These observations were made upon both isolated individuals, taken from a swamp in which they were scarce and from laboratory aquaria in which they were abundant. Fission of the individual did not always follow encystment. The process of encystment seemed rather to be a vegetative one to which propagation by fission was but incidental.

It is indicated, therefore, that this a-nucleated protozoon encysts in order to conserve its energy towards digesting and absorbing its food.

The writing of this note has been prompted by the fact that such thorough workers as Mast and Ibara had overlooked my observations and that for the good reason that they had been buried beneath a poor title.

WM. A. KEPNER

MILLER SCHOOL OF BIOLOGY,
UNIVERSITY OF VIRGINIA

UNIVERSITIES AND THE CIRCUS

WE have received the following communication purporting to come from the North American Circus Owners' League:

Editor of SCIENCE:

We are about to select one of the large eastern universities and to offer to it a substantial subsidy for providing instruction for future circus managers, artists and employees. We wish to ascertain unofficially, through your valued paper, if the rush of students to take these courses would not seriously interfere with the quieter and less practical courses now given, and thus possibly cause us some undesirable publicity.

Some universities are already training cooks, salesmen and plumbers, and are teaching the laying of eggs, horseshoeing, etc. A careful study of their present courses of instruction has led our educational committee to believe that most subjects of importance in our profession could be given by the existing departments, with a slight adaptation of problems and terminology.

Members of our committee have personally attended the so-called Spring-Day, Mud-Rush, and other similar performances at some universities, and also various impromptu rough-house affairs on the campuses and down-town. They have satisfied themselves that plentiful acceptable circus material exists among the student bodies of our typical universities and colleges.

In offering our endowment to a university, we shall make two conditions: (a) That the requirements for passing a course in our line shall be considerably above the present educational standards, and (b) that no excuses for absence shall be considered unless accompanied by at least three separate medical certificates, each signed by a doctor of a different medical school, and all specifying an ailment substantially in the same part of the body.

For the training of managers, the present courses in bookkeeping, poster design and boxing could be admirably adapted. For training arena artists some universities already have physical directors, athletic coaches, horses, bulls, etc., while for laboratory exercises the students themselves could in turn take the part of wild animals.

A department of domestic science could give excellent instruction in the preparation of pink lemonade, redhots and popcorn, while the departments of oratory and psychology could teach the proper way of calling attention to such delicacies. The departments of chemistry, anatomy and law could give training in the scientific preparation of freaks for the side shows.

An assistant professor of clownry, a three-legged calf and a steam piano would be the only additional equipment needed to start with.

We shall be glad to have your impartial opinion in regard to the above proposal.

Yours truly,

HAGEN RING BARNLING,
Executive Secretary

[The foregoing satire on some present-day tendencies in our university instruction was written by Professor Vladimir Karapetoff of Cornell University. —*Editor.*]

[1] *The American Naturalist,* Vol. 40, p. 337.

[2] "Principles of Animal Histology," Dahlgren and Kepner, p. 273.

SCIENTIFIC BOOKS

Handbuch der Vergleichenden Psychologie. Edited by GUSTAV KAFKA. Band I: Die Entwicklungsstufen des Seelenlebens, 526 pp. Band II: Die Funktionen des normalen Seelenlebens, 513 pp. Band III: Die Funktionen des abnormen Seelenlebens, 515 pp. Ernest Reinhardt, München, 1922.

COMPARATIVE psychology in this case is serviceably defined as a general method of inquiry. Too often the term has been used in this country for the study of the mental life of infra-human organisms.

Kafka's handbook, the most extensive work on comparative psychology ever published, consists of three volumes which represent and sample the abundant materials of the subject instead of exhausting them. The three volumes deal respectively with mental development, functions of the normal mind, and functions of the abnormal mind.

Volume I comprehends three parts: (1) Animal psychology, by Gustav Kafka; (2) Psychology of primitive man, by Richard Thurnwald, and (3) Child psychology, by Fritz Giese.

In Volume II there are five parts: (1) Psychology of speech, by Hermann Gutzmann; (2) Psychology of religion, by Georg Runze; (3) Psychology of art, by Richard Müller-Freienfels; (4) Social psychology, by Aloys Fischer, and (5) Vocational psychology, by Otto Lipmann.

The parts of Volume III are: (1) Psychology of the abnormal, by Hans W. Gruhle; (2) Criminal psychology, by M. H. Göring; (3) Psychology of dreams, by Sante de Sanctis, and (4) Psychology of sex, by Rudolf Allers.

The twelve parts of this important handbook differ extremely in method of treatment, inclusiveness and degree of adequacy. Each richly deserves special descriptive and critical comment, but in this brief review notice the work may be criticized only as a whole.

Each part is followed by selected bibliography. Naturally, and indeed inevitably, English and especially American contributions are less well represented than are European, in text and in bibliography. The handbook is the more valuable to American scientists because it presents in the main materials with which we are less familiar than with our own publications and which are relatively inaccessible because of language of publication or library deficiencies.

It is to be hoped that this admirable collection of special chapters in comparative psychology will encourage American teachers to extend their courses and to use more adequately, for instructional purposes as well as in supplementation of research, both the facts and the methods of such branches of the science as the psychology of primitive peoples, of children, of criminals, of social groups, of occupations, of defective and abnormal individuals, of speech, art—all these in addition to the data and methods of animal psychology which are so generally used as content of our courses in comparative psychology.

In the absence of any comprehensive English text on comparative psychology, a translation of this work is sure to be considered. Although its parts might with entire appropriateness be published separately in translation, it seems to the reviewer eminently desirable that the entire handbook be carefully rendered into English and published complete.

ROBERT M. YERKES

SPECIAL ARTICLES

AN INTERPRETATION OF ORTHOGENESIS

THERE is probably no evolutionary process about which more obscurity hovers than that of orthogenesis. The occurrence of "directive" evolution in characters that can not be supposed to be of selective value is often held to be incompatible with the view that evolution results from the action of natural selection on random variations. It is variously argued that the occurrence of orthogenetic series proves that variations do not occur in a random manner, that natural selection can not be the directive agent of evolution, or that the Lamarckian principle of the inheritance of acquired characters must be true. Weismann tried to account for the facts by the now discredited hypothesis of "germinal selection"—which at least had the merit of being an attempt at a mechanistic explanation.

One not familiar at first hand with the paleontological evidence may wonder if there is sufficient proof that orthogenetic series really occur, rather than being made up afterwards in the museum by the selection of just the appropriate specimens. But, if it be granted that some such series are genuine, there remains a simple method of accounting for them without making use of germinal selection, Lamarckianism, or any other primary factors than random variations and natural selection.

As was pointed out by Morgan[1] (1923), mutations in single genes usually produce changes in several characters. The geneticist commonly studies the obvious somatic variations, yet he knows that these are associated with physiological variations. Morgan

[1] Morgan, T. H., 1923. The bearing of Mendelism on the origin of species. *Scient. Mo.* 16: 237–247.

pointed out that these physiological variations are the ones most likely to be acted on by natural selection, and that such selection would be expected to bring about changes in the associated somatic characters that are themselves of little or no selective value. This seems to be the most probable cause of the very general occurrence of specific differences that can not be supposed to have any selective value.

One further addition to this idea makes it apply also to orthogenetic variation. If we suppose that variation in a given direction in character A is usually associated with variation in a given direction in character B, then selection of variations in character A will cause character B to change also. An example may make this point clear. If we suppose that the antlers of the Irish elk were dependent for their size largely upon testicular secretions, then selection may have increased the testicular secretions for reproductive or other reasons, and thus have resulted in a purely incidental increase in size of antlers.

In the example given it is assumed that the character not subject to selection is directly dependent for its degree of development upon another character whose variations have selective value. This direct relation is not necessary for the orthogenetic series—all that is required is that there be in general a correlation between the variations in two characters, even in cases where the genetic basis for the variations is not constant. It is, however, likely that diverse genetic changes will not usually produce parallel effects on different characters unless these characters depend on some common developmental process, the primary effect then being on this common process. It is not to be supposed that multiple effects of genes will always show such a correlation—but if such correlated effects do occur where one of the characters concerned is subject to natural selection, orthogenesis is to be expected.

One clear case of the sort of correlation discussed has been reported by Morgan, Bridges and Sturtevant (1921).[2] A large number of small-bristled mutant types occur in *Drosophila melanogaster,* and numerous other effects—roughened eyes, long development period, female sterility, etc.—are more or less regularly associated with the small bristles, though the genetic bases of the different types are quite distinct. It seems likely that natural selection, by operating to eliminate sterile females or slow growing larvae, has kept the bristles of the species large and the eyes smooth.

A. H. STURTEVANT

COLUMBIA UNIVERSITY AND
THE CARNEGIE INSTITUTION

[2] Morgan, T. H., C. B. Bridges, and A. H. Sturtevant, 1921. Annual report, in Year Book No. 19, Carnegie Institution of Washington, pp. 329–331.

THE SURFACE EQUILIBRIUM OF COLLOIDAL SOLUTIONS AND THE DIMENSIONS OF SOME COLLOIDAL MOLECULES

THE use of a long discarded method, fallen into disgrace because of its very sensitiveness and inherent difficulties, has made it possible to disclose and study a large number of phenomena connected with the surface tension of solutions, mainly colloidal solutions. The ring method as used by Sondhauss,[1] Timberg,[2] Cantor,[3] Weinberg,[4] and a few others, was difficult to apply and, notwithstanding the soundness of its principle, was never practical. The drop-weight methods with their numerous modifications were considered as ideal, because of the simplicity of the instrument and the excellent results which they yielded in the case of pure liquids. However, when very volatile or viscous liquids were dealt with, they were difficult to handle. They are always time-consuming if any degree of accuracy is required and, above all, absolutely unreliable in the case of colloidal solutions. Surface phenomena are, of course, particularly interesting when substances in solution are adsorbed in the surface layer. As long as it was believed that this adsorption took place almost instantaneously—and this is the general belief even now—there was no fundamental objection to the drop methods, as Gibbs' equilibrium was supposed to have been reached long before the drop would fall. However, such was not the case, as has been shown in an article which appeared in 1922 and other papers.[5] Time must be taken into consideration and more than one hour is required to reach the equilibrium. An interesting fact is that the instantaneous equilibrium of Gibbs, which is function of the concentration,[6] follows the same law as this time-adsorption, and may be expressed by the same equation, $\gamma = \gamma_0 e^{-Kt^{1/2}}$ in which the time t is replaced by the concentration c, namely: $\gamma = \gamma_0 e^{-Kc^{1/2}}$.

It was only through the ring method that it was possible to observe and study this phenomenon, as it is the only procedure which permits the measurement of the surface tension of the same layer of liquid at very short intervals. For this purpose, an instru-

[1] Sondhauss, *Pogg. Ann.*, 1878, Ergbd. 8, p. 27.

[2] Timberg, G., *Ann d. Phys. u. Chem.*, 1887, xxx, 545.

[3] Cantor, M., *Ann d. Phys. u. Chem.*, 1892, xlvii, 399.

[4] Weinberg, B., *Zeitschr. f. phys. Chem.*, 1902, x, 34.

[5] du Noüy, P. J., *J. Exp. Med.*, 1922, xxxv, 575, 707; *Compt. rend. Ac. Sc.*, 1922, clxxiv, p. 962; *ibid.*, 1923, lxxxix, 1076.

[6] Lewis, W. C. McC., *Proc. Phys. Soc.*, 1909, xxi, 150; *Phil. Mag.*, 1909, xvii, 466, etc.

ment was devised[7] which made it possible to make measurements in 15 seconds, reliable to 0.1 dyne. Since 1921, a little over 40,000 measurements of surface tension of colloidal solutions have been made in this laboratory, and the purpose of this paper is to summarize the results obtained thus far by this method.

(1) As mentioned above, the surface tension decreases in function of the time, according to an exponential formula: the drop is rapid at first (1 to 4 dynes in the first minute, according to the substance and the concentration). At the end of one hour, the rate of decrease becomes very slow, and the curve expressing the phenomenon, asymptotic to the axis of abscissae.

(2) Stirring even slightly, or shaking the solution after the lower value has been attained, causes an immediate rise in the surface tension which, however, does not generally reach its original value. Then it decreases again, and rises once more if stirred. The law of decrease is the same, only the coefficient K is changed, and its value becomes smaller every time.[5]

(3) When higher dilutions of the substances are used, the decrease of the surface tension becomes more rapid and the drop in function of the time greater, until a certain optimum dilution is reached. Then it decreases progressively. The value of this "maximum drop," even for fat-free substances, may be as high as 15 dynes (albumin) at a concentration of 1/80,000. Serum diluted 10,000 times shows a drop of 10 to 20 dynes in 2 hours; sodium oleate, glychocholate, etc., a drop of about 30 dynes at 1/100,000 in 2 hours. In these cases, the initial value of the surface tension is that of pure water.

(4) A close investigation showed the existence of sharp minima in the curve representing the values of surface tension of a certain number of colloidal solutions, plotted in function of the concentration. In the case of serum albumin and globulins, three main minima were found; in the case of sodium oleate, three were also found. In order to explain these minima, the hypothesis was brought forward that they correspond to polarized monolayers; (the writer proposes the term "monolayers" instead of the clumsy "monomolecular layer"). As the surface tension of water is high, and since only the substances which are capable of lowering its surface tension can be adsorbed in the superficial layer, it is clear that, if the molecules of these substances, instead of being piled up in disorder, are organized geometrically and symmetrically, their action on the surface tension of the solvent will be increased—hence the minimum in the curve. As soon as the dilution is increased, the number of molecules present decreases. They can no longer cover the surface with a continuous pavement and the surface tension rises. The other minima can be explained by the formation of a monolayer of *horizontal* molecules. Experiments showed that the colloid was adsorbed on the glass of the vessel, as well as on the free surface.[8] Knowing exactly the area of these two surfaces and the specific gravity of the substance, it was then possible to compute the thickness of these layers. For sodium oleate, the minima occurred at 1/750,000, 1/1,220,000, and at 1/1,390,000. The first minimum corresponded to a thickness of 12.30×10^{-8} cm; the second, to a thickness of 7.56×10^{-8} cm; the third, to a thickness of 6.64×10^{-8} cm. The length of the molecule of sodium oleate has never been measured, nor has that of the molecule of any colloid; but the length of oleic acid, a fat, has been measured by Langmuir,[9] and found to be equal to 11.2×10^{-8} cm. The difference between the two figures is only 1.1×10^{-8}, which is due to the additional sodium atom. This quantity does not express the length of the atom, but the projection of its actual distance from the oxygen atom to which it is linked, on the vertical axis of the molecule. The figure is well in accord with that which could be expected, and the hypothesis of the monolayer of vertically polarized molecules, based on the minimum of surface tension as a criterion, is probably well founded. The second minimum gives a thickness of 7.56×10^{-8}, which would then correspond to one of the dimensions of the base of the parallelopiped, and the third minimum gives a thickness of 6.64×10^{-8}, which is the second dimension of the base. Langmuir, in order to obtain the dimensions of the base of the molecule of oleic- acid, assumed that it was square, and took the square root of the surface experimentally found by him, *i.e.*, 46×10^{-16} sq. cm. This gave him 6.8×10^{-8} cm. which is intermediate between our two values.[10]

Serum albumin from rabbits shows minima around 1/100,000, 1/140,000, and 1/190,000. These correspond to thicknesses of about 55, 45 and 32×10^{-8} cm. It is probable that the monolayer whose thickness is 45.0×10^{-8} cm. represents vertical molecules, while that of 32.0×10^{-8} cm would correspond to horizontal molecules. Under these assumptions, the specific gravity being 1.265, the molecular weight would be comprised between 35,000 and 36,000. A similar figure is obtained for the globulins.[11]

[7] du Noüy, P. L., *J. Gen. Physiol.*, 1919, i, 521; *La Nature*, 1920, No. 2391, p. 63; H. N. Holmes (Laboratory Manual of Colloid Chemistry, 1922; Sir W. M. Bayliss, The Colloidal State, Oxford Med. Publications.

[8] du Noüy, P. L., *Jour. of Exp. Med.*, in press.

[9] Langmuir, I., *J. Am. Chem. Soc.*, 1917, xxxix, 1848.

[10] du Noüy, P. L., *C. R. Ac. Sc.*, T. 178, p. 1102, 1924, and *Jour. of Exp. Med.*, in press.

[11] du Noüy, P. L., *Philosophical Magazine*, in press.

From the dimensions found for the sodium oleate molecule, the volume is readily calculated—$V = 12.3 \times 7.56 \times 6.64$ cc. $\times 10^{-24}$. By multiplying by the specific weight (0.821), the weight of each individual molecule is obtained—507×10^{-24} grams. Hence a new method is found to calculate the number N of Avogadro, since the molecular weight is well known and equal to 304.35. In this manner we obtain for the number N the value, 6.003×10^{23}, while Millikan's last figure is 6.062×10^{23}. The probable error in our figure is 0.15 per cent., or

$$N = 6.003 \pm 0.08.$$

This method is probably the more direct, and is based only on Avogadro's definition of the number N. The details of this work, and a discussion of it, will appear shortly in the *Philosophical Magazine*.

P. LECOMTE DU NOUY

THE ROCKEFELLER INSTITUTE FOR MEDICAL RESEARCH

THE AMERICAN CHEMICAL SOCIETY

DIVISION OF ORGANIC CHEMISTRY

R. R. Renshaw, *chairman*
J. A. Nieuwland, *secretary*

Introductory remarks: GILBERT N. LEWIS.

The mechanism of ester formation: JAMES F. NORRIS and FRANCIS B. STEWART. The velocity constants for the esterification of ethyl, normal butyl, secondary butyl and tertiary butyl alcohols with acetic and trichloroacetic acids with and without a catalyst were determined. The results show that the ratio between the constants in the uncatalyzed and catalyzed reactions for a given acid are about the same, whichever alcohol is used. On the other hand, in the case of any alcohol this ratio varies widely as the acid is changed. The results furnish experimental evidence for the conclusion that the catalyst functions through its action on the acid and not the alcohol. With the weak acid the influence of the catalyst is very great compared with its influence on the strong acid in increasing the rate of the reaction. The ratio of the velocity constants of the catalyzed reactions between a given acid and different alcohols is approximately the same as the ratio between the reactivities of the hydrogen atoms in the hydroxyl groups in these alcohols, and varies widely from the ratio between the reactivities of the hydroxyl groups. These facts show that in ester formation the hydroxyl group is furnished by the acid and the hydrogen atom by the alcohol.

Reactivity in acetal formation: HOMER ADKINS and E. W. ADAMS. The problem of the relationship between structure, reactivity (Michael) and rate of reaction has been studied by determining the equilibrium point and the rate with which it is reached, in the formation of about forty acetals. It has been established that there is no relationship between reactivity and rate of reaction. The reactivity and effect on rate of reaction of a number of groupings has been determined (eleven of the lower alkyls, phenyl in various positions, olefinic linkage, etc.). The significance of these facts in interpreting the mechanism of the reaction has been considered.

The mechanism of reduction in homogeneous solution: J. B. CONANT and H. B. CUTTER. The following types of reductions can be accomplished by such reducing agents as titanous chloride, vanadous chloride and chromous chloride; (1) reversible monomolecular reduction; (2) irreversible monomolecular reduction with or without cleavage; (3) reversible dimolecular reduction (formation of free radicals); (4) irreversible dimolecular reduction (pinacone formation). All these processes are conditioned by the reduction potential of the reducing agent, the hydrogen ion activity of the medium and the nature of the organic substance which in (1) and (3) can be measured as a potential. The irreversible processes probably proceed through a reversible phase which also has a characteristic reduction potential. Examples of (4) are the dimolecular reduction of benzaldehyde, and alpha, beta unsaturated ketones by vanadous salts.

Mechanism of vapor phase oxidation: R. T. HASLAM. This paper reviews the various theories offered for the mechanism of combustion of hydrocarbons. These theories are discussed in view of the existing experimental data on the subject and the theory that hydrocarbons burn by means of successive hydroxylations together with the importance of this concept is treated at some length. It is conclusively shown that the vapor phase oxidation of organic compounds other than straight chain hydrocarbons, although little studied, is different from the oxidation of the same compounds with liquid oxidizing agents. Some conclusions are drawn about the influence of substitution and of the relative position of groups in a molecule on their oxidability. As a practical application of the knowledge of the subject, it is shown how the burning of hydrocarbons can be improved by favoring the hydroxylation process, thus eliminating the formation of soot.

The mechanism of oxidation of organic compounds with potassium permanganate: WILLIAM LLOYD EVANS. This paper deals with mechanism of the oxidation of organic compounds in aqueous solutions by means of potassium permanganate alone, and also in the presence of added potassium hydroxide. The purposes of these oxidations have been to ascertain the several molecular stages through which certain organic compounds pass when they undergo this type of chemical change. These oxidations have been studied under chosen conditions of temperature and initial alkalinity with a view of ascertaining the effect of these variable factors on the course of the oxidation. The experimental results thus obtained have been used to deduce an appropriate mechanism which will best explain the observed oxidation phenomena. The following compounds have been made the object of

such investigations: Ethyl alcohol, acetaldehyde, isopropyl alcohol, acetone, acetal, d-glucose, d-galactose, d-fructose, d-mannose, lactose, sucrose, maltose, cellose, mannitol, dulcitol and sorbitol. In all cases many of the theoretically possible intermediate compounds have been studied under exactly the same experimental conditions in order to aid in the determination of the exact course followed in these several reactions.

The mechanism of some Grignard reactions: HENRY GILMAN and co-workers. The reaction between R Mg X compounds and the so-called disulfoxides shows these compounds to have the thiosulfonic ester structure. With alpha disulfones and ketone-sulfones splitting occurs between the two characteristic groups. In connection with some studies on the electronic interpretation of reactions, preliminary experiments indicate that the Grignard reagent will not add to variously substituted ethylenic linkages.

The mechanism of the Friedel Crafts reaction: CECIL E. BOORD. The reaction products described by Mouneyrat, formed by the action of anhydrous aluminium chloride upon alkyl halides are used in the explanation of the Friedel Crafts reaction and extended to include the condensation of olefines with aromatic compounds in the presence of aluminium chloride.

(1) a $C_2H_5Cl + AlCl_3 = ClCH_2 - CH_2AlCl_2 + HCl$

b $CH_2CH_2 + AlCl_3 = ClCH_2 - CH_2AlCl_2$

(2) $C_6H_6 + ClCH_2 - CH_2AlCl_2 = C_6H_5CH_2 - CH_2AlCl_2 + HCl$

(3) $C_6H_5CH_2 - CH_2AlCl_2 + H_2O = C_6H_5 - C_2H_5 + Al(OH)Cl_2$

A similar type of formulation is indicated for the condensation products formed by mercuric salts with olefines, since these react with aromatic derivatives to give condensation products which upon hydrolysis yield the alkylated aromatic derivatives. Zinc chloride also reacts with olefines to form addition products. These zinc chloride-olefine addition products condense with aromatic derivatives, particularly phenols, and by subsequent hydrolysis yield alkylated derivatives. These facts seem to indicate a similar mechanism for the condensation of monohydric alcohols with phenols in the presence of anhydrous zinc chloride.

The probable formation of 4-membered cyclic derivatives as intermediates in organic reactions: HAROLD HIBBERT and EARL M. BILGER. The views previously advanced by Hibbert and Montonna on the rôle of cyclic derivatives in ester formation (Tischtschenko reaction) and the synthesis of alpha chloro esters have been extended to the mechanism of reactions involving the synthesis of a wide variety of organic compounds. The theory assumes that when two derivatives containing unsaturated linkages react together the first stage of the reaction consists in the formation of a 4-membered ring.

$$A=B + C=D \rightarrow \begin{matrix} A-B \\ | \quad | \\ C-D \end{matrix} \quad \text{or} \quad \begin{matrix} A-B \\ | \quad | \\ D-C \end{matrix}$$

Such a ring system is characterized by the ease with which an atom (H; Cl) attached to atom A migrates to D (that is, from a 1- to a 5-position), this being accompanied by ring opening. The theory offers a simple explanation of the following reactions: (a) Acid chlorides and aldehydes; (b) aldol formation; (c) aldehydes with sodium nitro methane, hydrocyanic acid and sodium bisulfite; (d) guanidine and carbon bisulfide; (e) ethylene with organic and inorganic acid, phosgene, ureas and thioureas; (f) polymerization of styrene and methylene hydantoin; (g) ketenes and aldehydes.

GENERAL PROGRAM

Present status of the Crum-Brown-Gibson rule and a new theory of the mechanism of substitution in monosubstituted benzenes: E. M. TERRY and L. EICHELBERGER. Complete tables of the exact data on substitution in monosubstituted benzenes have been made. From these, briefer tables will be taken and shown. It will be seen that a new rule of substitution is justified. The fundamental basis of the new rule will be pointed out.

A chemical method for estimating the meta isomer in some disubstituted derivatives of benzene: A. J. HILL and A. W. FRANCIS. The method as applied to amino and phenolic compounds consists in titrating with a standard bromine solution. Meta compounds are tribrominated, while ortho and para compounds receive only two equivalents. The actual bromine consumption thus gives the percentage of the meta isomer. Nitro compounds are estimated by preliminary reduction with standard titanous chloride to the corresponding amino compounds, which are then titrated in the same solution with bromine. In some cases the solution must be cooled to zero to prevent oxidation or displacement of a group. The method has been applied successfully to twelve systems of isomers.

A comparative study of the Beckmann rearrangement of some hydroxamic acid derivatives: A. W. SCOTT. (1) The effect of temperature of the dry sodium, potassium and silver salts of the acetyl and benzoyl esters of hydroxamic acids derived from acetic acid, propionic acid and benzoic acid was studied. (2) The temperature of rearrangement in aqueous solutions of the sodium and potassium salts was also studied. The ease of the rearrangement seems to depend upon the influence of the hydrocarbon radicals of the acyl groups from which the hydroxamic acids were originally prepared. Including a similar study of isobutyl hydroxamic acid derivatives (Jones and Scott) (*J. A. C. S.*, 44, 407, 1921) the ease of the rearrangement in terms of the hydrocarbon radicals may be expressed in the following sequence: Phenol, isopropyl, ethyl, methyl.

Methyl ethyl sulfate as an alkylating agent: F. K. THAYER. (By title.) Methyl ethyl sulfate can be prepared only by reacting alcohol-free sodium methylate with an ether solution of the ethyl ester of chlorosulfonic acid. The yield is poor on account of side reactions. In order to obtain a comparison of the alkylating powers possessed by the methyl and the ethyl group, standard conditions

were formulated by alkylating phenol with dimethyl sulfate. Under these standardized conditions phenol was alkylated with 1 mol. of ethyl methyl sulfate. Of the total amount of alkylation performed upon the phenol by $(CH_3)(C_2H_5)SO_4$, the methyl group was responsible for 80.2 per cent. and the ethyl group for 19.8 per cent.

Nitro-cresols and their mercury derivatives: G. W. RAIZISS, A. PROSKOURIAKOFF and B. C. FISHER. One of the authors (Raiziss) has found previously in the study of mercuri-nitro phenols that the introduction of a nitro group into a certain organic compound of mercury greatly enhances the bactericidal properties of the latter. A similar biochemical study has been made by the authors on mercury derivatives of various mono-nitro-cresols. Ten nitro-cresols are theoretically possible, of which the authors prepared seven, also their organic mercury derivatives. While preparing these nitro-cresols, it was necessary in some instances to improve upon methods of preparation and purification of some of them. Better yields were secured, and purer products obtained. The mercuration of the nitro-cresols resulted in the preparation of new products. Some were obtained crystalline and very pure. This can not be always accomplished, as organic mercury derivatives of the type studied are difficult to isolate in pure crystalline form. Among the mercury derivatives one was found valuable from the biological viewpoint, the chemical name being 4-nitro-3, 5-bisacetoxymercuri-2-cresol. It is distinguished by its very high destructive action upon staphylococci, being employed now in the therapy of various infectious diseases with good results.

The reduction of oximes to amines: L. C. RAIFORD and E. P. CLARK. The reduction of oximes with specially prepared sodium amalgam (Raiford and Clark, *J. A. C. S.*, 45, 1738 (1923)) in accordance with the directions previously reported (SCIENCE, N. S., 58, 471 (1923)) has been studied in nine additional cases. In each instance the compound has also been reduced with aluminium amalgam. In the latter case the water or dilute alcoholic solution of the oxime was usually allowed to stand over night with about two molecular proportions of the amalgam, after which the mixture was made alkaline with sodium hydroxide and distilled with steam. The amine was isolated as the hydrochloride. When sodium amalgam was used in acid solution, sodium acetate was used as a buffer, and the mixture kept constantly acid to litmus with acetic acid. When the liquid was kept alkaline to litmus, hydrochloric acid was used to neutralize the excess of alkali. With oximes containing aromatic radicals, the best results were usually obtained in the following order: Aluminium amalgam, sodium amalgam (alkaline), sodium amalgam (acid). With those containing aliphatic radicals, the order was: Aluminium amalgam, sodium amalgam (acid); while with sodium amalgam in alkaline solution, the action goes very slowly or not at all.

Organic mercury compounds obtained from naphthalic acid and other dibasic acids (Preliminary Paper): FRANK C. WHITMORE and G. J. LEUCK. Heating the mercuric salt of naphthalic acid (naphthalene-1, 8-dicarboxylic acid) gives results similar to those obtained with mercuric phthalate, carbon dioxide being eliminated and a carbon-mercury linkage formed. The mercurated product reacts with acid to give very pure alpha naphthoic acid. Similar experiments have been carried out with nitro-naphthalic acids. The 3-nitro compound reacts more rapidly than the unsubstituted substance and the 4-nitro compound reacts much more slowly. Treatment of the mercurated products with acid gives 6-nitro- and 4-nitro-naphthoic acids, respectively. Similar studies are being carried out with diphenic acid and with a number of other dibasic acids, both aromatic and aliphatic, to find the effect of constitution on the reaction.

Action of organic mercury compounds with organic halides—II: F. C. WHITMORE and N. THURMAN. The action of mercury di-p-tolyl with 30 organic halides has been studied. In most cases there is no action even after refluxing the reactants in toluene for three or four hundred hours. Large quantities of materials were used so as to make possible and practically quantitative recovery of the unchanged substances. In some cases the mercury compound acted as a hydrocarbo base removing HX from the halide. Thus, ter-butyl bromide yields butylene. The only case in which halogen attached to carbon was found to act metathetically was diphenyl-bromo-methane, which yields p-tolyl-diphenyl-methane. The analogous compound, diphenylene-bromo-methane, loses hydrobromic acid to give bis-diphenylene-ethylene. Of the various types of bases, such as hydro-bases like sodium hydride, ammono-bases like sodamide, aquo-bases like sodium hydroxide, and hydrocarbo-bases like the Grignard reagents and organic mercury compounds, the last named are by far the least active toward organic halides. However, when reaction does occur it is similar to that obtained with the other types of bases.

The preparation of halogenated benzoic acids from organic mercury compounds (Preliminary Paper; by title): F. C. WHITMORE, G. WOODWARD and W. B. GERY. Mercurated benzoic acid is prepared either from benzoic acid or better from phthalic anhydride. Treatment with halogen gives the ortho halogen benzoic acid in good yield and high purity. Mercuration of product followed by treatment with same or different halogen gives di-ortho halogen benzoic acid. Para halogen benzoic acids are made from crude p-tolylmercuric chloride by permanganate oxidation to p-chloromercuri-benzoic acid, and subsequent treatment with halogen. Mercuration of the products followed by treatment with halogen gives ortho-para di-halogen acids. From these substances the tri-halogen benzoic acids will be prepared in similar way. The best method for making diphenic acid for another research has been found to be the treatment of methyl ortho-bromobenzoic acid prepared from phthalic anhydride as above, with metallic copper to give diphenic ester. The research is being continued with the carboxylic acids of naphthalene and similar substances.

J. A. NIEUWLAND,
Secretary

(To be continued)

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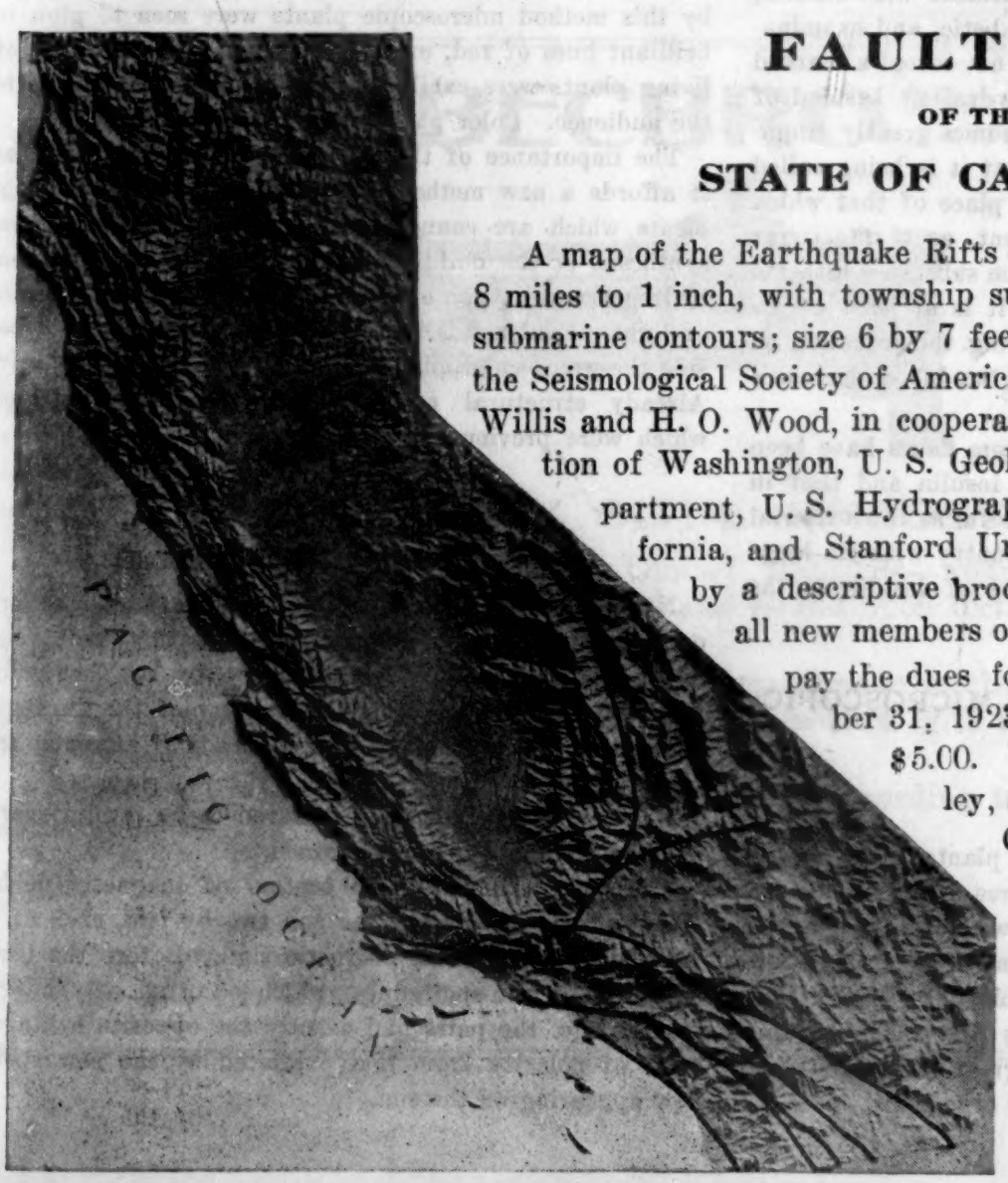

FAULT MAP

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A map of the Earthquake Rifts of the State of California, scale 8 miles to 1 inch, with township subdivisions, relief shading, and submarine contours; size 6 by 7 feet, in four sheets. Prepared by the Seismological Society of America, under the direction of Bailey Willis and H. O. Wood, in cooperation with the Carnegie Institution of Washington, U. S. Geological Survey, U. S. Navy Department, U. S. Hydrographic Office, University of California, and Stanford University. 1922. Accompanied by a descriptive brochure. This map will be sent to all new members of the Seismological Society, who pay the dues for 1923, ($3.00), before December 31, 1923, or is for sale, unmounted, for $5.00. Write to Professor S. D. Townley, Secretary, Stanford University, California.

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SCIENCE NEWS

THE EFFECT OF INSULIN ON BODILY PROCESSES

Science Service

INSULIN provides a key that may serve to open the doors to hidden mysteries of metabolism, Dr. J. J. R. Macleod, of the University of Toronto, one of the winners of the Nobel prize for medicine, told the American Association for the Advancement of Science on December 29 during a symposium on the ductless glands.

In addition to proving successful as a remedy for diabetes, this powerful drug is being used by the physiologist as a new instrument for learning the mechanism of the normal, healthy human body.

A large amount of work has been done on the action of insulin on normal animals, and the immediate effect of its injection is to lower the blood-sugar. This occurs so rapidly as to give the impression that the hypoglycaemia must be due to changes occurring in the blood itself. Investigation has shown, however, that the decrease is due to a rapid disappearance of sugar from the tissues, leading to a secondary removal of sugar from the blood. The cause for the creation of this "vacuum for sugar in the tissues" is obscure; no glycogen is formed in the normal animal following treatment with insulin, contrasting with the effect on the diabetic, and examination of the respiratory quotient does not reveal a marked increase in the combustion of carbohydrates. Instead of glycogen being formed it actually becomes greatly diminished, the reason being, no doubt, that it is being called upon to produce glucose to take the place of that which has disappeared. It looks, at present, as if the sugar disappears by being changed into some substance hitherto undetected by chemical means, and it is at least of interest in this connection that following the injection of insulin the free phosphoric acid of the blood decreases parallel with the decrease of sugar.

Dr. Macleod stated that glands from fishes have been found to contain large amounts of insulin and that in maritime countries they may prove useful as raw material for insulin manufacture. In this country with its large abattoirs, the more profitable source of insulin is the pancreas of cattle and pigs.

COLOR PHOTOGRAPHS OF MICROSCOPIC PLANTS

Science Service

COLOR photographs of microscopic plants, taken by the light emitted by the plants themselves after stimulation by a strong beam of light, were shown before the American Association for the Advancement of Science on December 29 by Professor Francis E. Lloyd, of McGill University. The photographs were the first taken by this method which is expected to be of great value in studies of the purpose of pigments in living organisms.

"Plants contain," said Professor Lloyd, "a considerable number of pigments which have the property of fluorescence, a property due to the ability of the pigment to change the wave length of the blue-white part of the spectrum into the longer wave lengths, green, orange and red. In the case of green pigments, the result of this property is to produce red light even though no red light is supplied.

"The attempt has often been made by various workers to see fluorescence in living microscopic plants by means of the microscope, making use of a special optical arrangement known as the dark field illuminator. The lack of success following these attempts led to the conclusion this was not possible. Indeed, the only way in which fluorescence has been seen microscopically in the living organism is by means of a very special optical arrangement known as the fluorescence microscope, or one in which only ultra-violet light is permitted as an illuminant. Since the visibility is low, no structures can be seen, nor can high magnification be successfully used."

Professor Lloyd then described a method of his invention whereby the dark-field illuminator can be so adjusted as to project a strong beam of light upon microscopic organisms in such a way as to bring out a brilliant fluorescence and also reveal their structure. When viewed by this method microscopic plants were seen to glow in brilliant hues of red, orange or yellow. Preparations of living plants were exhibited in which this was visible to the audience. Color photographs were also shown.

The importance of this discovery lies in the fact that it affords a new method of studying in plants the pigments which are connected with the process of photosynthesis, or the building up of tissue from the carbon, hydrogen and oxygen of air and water through the action of light. Evidence is increasing that other pigments beside the green chlorophyll are of importance in this way. Already structural relations have been demonstrated which were previously not understood.

SUN-SPOTS

Science Service

NEW sun-spots now appearing on the sun's disc are opposite in magnetic polarity to those that were seen during the last cycle. This discovery, by Dr. George E. Hale, of the Mount Wilson Observatory of the Carnegie Institution, is the result of over a decade of astronomical observations.

The new observations are declared to be revolutionary and the findings to be unexplained.

The spots, known to be centers of magnetic fields, travel across the disc of the sun two by two, each of a pair being of different magnetic sign. Before the time of minimum sun-spottedness which occurred only a few months ago, the pairs had exactly the opposite arrangement of polarity from that exhibited by the new spots now appearing on the sun.

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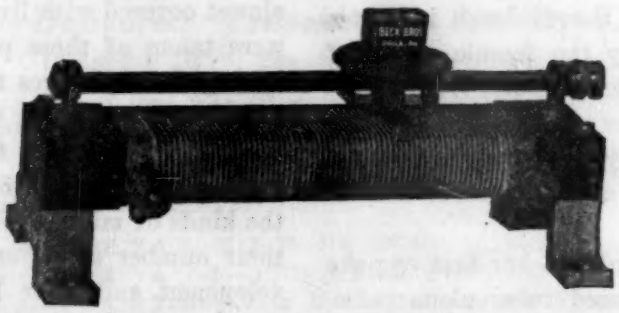

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This is taken to mean that the true cycle of sun-spots is just double the 11⅛ years now assumed and that the spots pass through two minima and maxima before a similar condition is repeated.

Just what effect this has on matters here on earth is yet to be determined although sun-spots are known to affect both the magnetism of the earth and the solar constant of radiation.

It is believed that the peculiar rotation of the sun which is faster at the equator than at the pole is related to sun-spot phenomenon.

CHANGE OF SEX IN PIGEONS

Science Service

COMPLETE transformation of an adult female pigeon into a fully developed male bird, indicating that man's inherited bodily and mental characteristics may be considered as subject to change and control, was reported by Dr. Oscar Riddle, of the research staff of the Carnegie Institution, to members of the American Society of Zoologists meeting in Cincinnati on December 28. Dr. Riddle believes that the scientific importance of this reversal of sex can scarcely be exaggerated.

The bird was a female blond ring dove, and at the beginning it was a normal female like thousands of other doves and pigeons which have been studied at the Institution's Station for Experimental Evolution at Cold Spring Harbor, Long Island, during the past 13 years. She laid eleven eggs between January 27 and April 15, 1914. These eggs were carefully examined and details concerning them recorded. A few months later, the bird began to act like a male. Still later, the former female took on weight and developed the crow of the cock pigeon.

After the last eggs were laid, the evidence indicates that tuberculosis began to destroy the female gland of this bird. The bodily condition which results from tuberculosis is known to approach the condition which our earlier studies have shown to be typical or necessary for the development of the male sex, and adverse to the development of the female sex.

Forty-four months after this bird laid her first egg she died. The autopsy showed advanced tuberculous infection of the spleen, liver and other organs. No female glands were found, but two well-formed male glands in their normal position were present.

Dr. Riddle presented complete records for the period of egg-laying and for all later periods to the time of death. Figures and curves showing the progressive change in the body weight of this bird during this same period were also presented and described.

Dr. Riddle claims that "The result clearly indicates that the hereditary basis of no bodily or mental characteristics may be considered as irrevocably fixed and uncontrollable," and that as one of the characteristics known to be hereditary and normally to be controlled through the so-called "chromosomes" of the germ cell has been shown to be capable of a reversal to the alternate form, it becomes wholly probable that all hereditary characteristics of every human being and of every organism are capable of reversal and modification; and that the accomplishment of such modification and control is a matter which merely awaits the definitely directed effort of investigators.

FISHING FOR MICROSCOPIC PLANTS

Science Service

FISHING for microscopic plants by suspending glass plates in the sea, it is stated, offers a new and important scientific method for investigating the habits of fish and other ocean animals. Professor Orville Turner Wilson of the University of Cincinnati, described the system to the Botanical Society of America on December 28 and told how effective he had found it in his work at the Scripps Institution for Biological Research near La Jolla, California.

The ocean waters near shore are swarming with tiny plants and animals. Of the plants the diatoms are most numerous. Because of the beautiful markings of their glassy walls and because of their remarkable symmetry of form they have always been favorite subjects for study with the microscope. It has been the custom to collect them in bottles of sea-water and examine drops of the water to find them. In this way the individual plants could be examined but little information was gained as to their habits of living or their natural groupings.

By removing one of the glass plates from the water each day and studying it in the laboratory, it was possible to note the methods by which the diatoms attach themselves to hard surfaces; the natural groupings of these plants; the growth and form development of the individuals; the competition and survival illustrated in these miniature societies; and their relation to other plants and animals. In a very few days the plates were almost covered with living organisms. Many photographs were taken of these plates, some species new to science having their pictures taken for the first time.

Dr. Wilson asserts that this type of fishing for creatures that were not fish was as fascinating as it was unique. The method is a promising one for investigating the kinds of microscopic plants and animals in the water; their number at different seasons of the year, their development and their life-habits. These matters are of vital importance in investigating the habits of fish and other ocean animals which use the microscopic plants and animals for food.

THE PROJECTED FLIGHT OF THE SHENANDOAH

Science Service

THE *Shenandoah* in her projected flight over the unexplored Arctic Ocean north of Alaska may make discoveries which will have great value in forecasting North American weather, according to Major E. H. Bowie, supervising forecaster of the U. S. Weather Bureau. If land is discovered in that vast region, and especially if it be of large area, it might possibly serve as a location for an outpost of the Weather Bureau to stand guard over this breeding place of cold waves.

For the entire polar cap is, said Major Bowie, a vast

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reservoir into which flows, settles and becomes unduly cold the air of the northward flowing currents from southern latitudes, and especially is this true during the long winter night of the polar region, a night which north of the Arctic Circle begins in September and ends in March. These northward flowing aerial rivers chilled on their way north, by contact with ice and snow-covered surfaces, and by rapid loss of heat by radiation, pass on to the polar basin, settle to the earth's surface and build up, it is believed, a great semi-permanent area of high barometric pressure. This results from the increasing weight of the cold air, and to this the incoming air flowing in aloft from regions farther south, is added.

At intervals and especially in winter, this reservoir of cold outflows and spills southward into the temperate zone, the force of its flow being sometimes enough to carry relatively cool air all the way to the tropics. If it could be known when this was about to occur it would be possible to make forecasts of cold waves or of colder weather for a week or more in advance, while, on the contrary, if the polar reservoir of air were known to be depleted, a northward flow of warm air over the temperate zone might reasonably be expected, bringing a hot wave in summer and mild weather in winter.

The Weather Bureau now has a number of stations in Alaska, but the northernmost of these are in the Yukon valley. If one might be established at Pt. Barrow on the northern coast and another several hundred miles north on the land supposed to exist there, these changes in the quantity of air in the polar reservoir might be more readily seen and their effects predicted. So the bureau is keenly interested in what the *Shenandoah* may find.

THE METRIC SYSTEM

Science Service

DR. HARVEY W. WILEY, in an address to the Metric Association at Cincinnati, urged that efforts be made to secure a law requiring all government business to be transacted in the metric system. This, he said, would pave the way for the speedy education of our people and lead almost automatically to the gradual extension of the metric system into all forms of business. He believes that the metric system of weights and measures would greatly simplify teaching in schools and promote honesty in trade.

Pointing out the tendency to fraud fostered by the present use of many weights and measures, he said:

"A short time ago a grocer in the city of Washington was arrested for selling short-weighted articles. In his defense he said that he had always understood that twelve ounces made a pound. It is possible his father was a druggist, and he had thus inherited a propensity which proved extremely profitable in his business. I doubt if any court would have been able to convict this party of fraud, unless the particular law applying to such cases should have defined the pound as 'avoirdupois.' Even the term 'avoirdupois' might have been subjected to legal possibilities. It means, 'to have some weight,' and a troy pound also has weight.

"Any system of weights and measures which is variable, indefinite, unscientific, unrelated, and which is differently defined in laws of the different states and municipalities gives an opulent opportunity for deception and fraud.

"If there are two or three kinds of tons—and there are three kinds—unless some agreement is made, the buyer will want to get the biggest ton and the seller will want to sell the smallest ton. There are more different gallons than there are different tons, and when it comes to barrels the variation is even greater."

In Washington, where the law requires a long ton of coal, coke is always sold by the short ton. The buyer naturally thinks he gets a long ton of coke. But coke is not mentioned in the act.

ITEMS

Science Service

THE active principle of bee stings in their curative effect upon rheumatism is being sought for by German scientists who are trying to produce a remedy for the disease which will be as effectual as the stings and which may be administered with less discomfort and inconvenience. It seems to have been demonstrated that while 100 or more bee stings cause very disagreeable constitutional symptoms such as dizziness, fever and nausea in non-rheumatic subjects, the same treatment applied to rheumatic subjects causes less discomfort at the start and later, in many cases, a cure of the disease. The healing factor is supposed to be a protein which acts like the milk injections which are largely used at present as a remedy. If the protein can be isolated the sufferers from rheumatism have hopes of a cure without being stung.

MOTION pictures as a help to health were advocated at a session of the Health Education Section of the association. James A. Tobey, administrative secretary of the National Health Council, said movies can aid in health promotion by their demonstrations of correct methods of personal hygiene. He urged a wider use of health movies similar to those now used in Massachusetts, where the hygiene division of the State Department of Health employs films for that purpose.

THE size of icebergs is generally overestimated, Professor Robert DeC. Ward, of Harvard University, told members of the American Meteorological Society meeting at Cincinnati. Professor Ward spent two weeks last June on one of the U. S. Coast Guard cutters engaged on ice patrol duty off the Grand Banks. The tallest berg measured by the ice patrol during the past four years was stated to have been 248 feet high at its highest point; while the longest was 1,690 feet from end to end. The blowing up of icebergs by gun-cotton wrecking mines was only practicable when the berg was old and partly disintegrated. Dr. Ward saw one in this condition blown up and he estimated that its life as a danger to shipping was shortened by at least two days. Illustrating the magnitude of the task and the impossibility of completely destroying the larger bergs, he told of seeing one which was estimated to contain 36,000,000 tons of ice.

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As the number admitted to each class is limited, applications must be made before July 1.

Dean, Yale University School of Medicine

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SCIENCE NEWS

NOTABLE PROGRESS MADE IN SCIENCE DURING 1923

Science Service

IMPORTANT progress in all fields of science were made during the past year.

Outstanding events in astronomy included the discovery of the reversal of polarity of sun-spots and confirmation of the second and third predictions of the Einstein theory.

A new type of boiler and turbine using mercury instead of steam promises to revolutionize power production.

Missing chemical element No. 72 was discovered, named "hafnium," and found to be like zirconium.

Dinosaur eggs, ten million years old, were discovered in Asia.

Pictures were sent by radio, and the continent was crossed in a non-stop airplane flight.

Insulin as a remedy for diabetes was put into general use.

Important events in various fields included:

ASTRONOMY

Einstein's third prediction as a consequence of his theory of relativity, that spectral lines are displaced under the influence of the gravitational field of the sun, confirmed by Dr. Charles E. St. John, of Mt. Wilson Observatory.

Dr. W. W. Campbell, of Lick Observatory, announced that photographs of 1922 Australian eclipse expedition confirmed the Einstein theory.

Decrease of 4 per cent. in the heat of the sun during the late months of 1922 and the early months of 1923 announced by Dr. C. G. Abbot, of the Smithsonian Institution.

Discovery of the second closest visible star, "Epsilon Indi," seven light years distant, by the Harvard College Observatory.

Discovery of the densest star, not yet named, in the constellation "Coma Berenices" by the Allegheny Observatory.

Total eclipse of the sun occurred on September 10, but observations in California and Mexico were a partial failure because of cloudy weather.

The Greek church replaced the Julian calendar with the Gregorian.

A new asteroid was discovered by Professor George H. Peters, U. S. Naval Observatory.

Harvard College Observatory announced that Nova Aquilae No. 3, the brightest new star seen for centuries, has faded down to normal star brilliance.

Observation of the tail of Baade's comet pointed toward the sun instead of away from it, as is usual, puzzled astronomers at Yerkes Observatory.

Discovery of the reversal of magnetic poles of sunspots by Dr. George E. Hale, of Mt. Wilson Observatory, opened a new field in the study of sun-spot phenomena.

Distribution of heat in the spectrum of stars, determined by Dr. C. G. Abbot, working at Mt. Wilson Observatory, was found to differ from distribution of light.

BIOLOGY

Germans announced that sodium di-hydrogen phosphate in moderate doses increases endurance and enables greater physical output without exhaustion.

Complete sex-reversal in a hen, which, after having laid many fertile eggs, became the father of healthy chicks, reported to the British Association for the Advancement of Science.

Experiments at Birmingham University, England, indicated that drinking salt water in moderate amounts is a preventive of heat exhaustion.

Professor G. W. Cavanaugh, of Cornell, announced that vitamin C is present in milk only when cows eat green feed.

Professor Ivan G. Pawlow, Russian physiologist, announced that mice inherit ability to learn.

Ether found to stimulate growth of dormant plants.

Dr. Herbert Evans and Dr. K. Scott Bishop, of the University of California, announced discovery of vitamin X in lettuce, alfalfa, egg yolk and fresh meat, necessary to animals before they can produce young.

Rockefeller Foundation pledged $325,000 for biological research fellowships under the National Research Council.

Dr. Charles A. Kofoid, of the University of California, announced the discovery of high-speed evolution among microscopic parasites in the bodies of ants.

Photography of plants by the light given out by their own fluorescent pigments has been accomplished by Professor Francis E. Lloyd, of McGill University. It has revealed new uses for some of their structures not previously suspected.

The thymus gland was found to be indispensable in birds and other lower vertebrates for the production of egg membranes and shells. In mammals, including man, it is not of great importance.

PHYSICS AND CHEMISTRY

New "Zeta" rays resulting from atomic collisions discovered by Professor W. D. Harkins, of University of Chicago.

Method for spraying metals on cold surfaces has been announced by U. S. Bureau of Standards.

Voltage of a lightning flash has been measured and found to be about 100,000,000.

A device to eliminate undesirable noises, by making sound waves interfere with each other, has been invented by Dr. G. W. Stewart, of the University of Iowa.

Missing chemical element No. 72 has been discovered by Drs. D. Coster and G. Hevesy, of Copenhagen, and named "hafnium."

How the apple's odor can be made synthetically for use in soft drinks was discovered by Dr. Frederick B.

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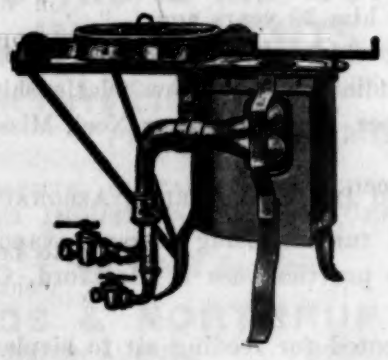

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Power and V. K. Chesnut, of the U. S. Bureau of Chemistry.

A new compass for ships has been perfected at U. S. Bureau of Standards.

A new motion picture camera and projector for amateurs using small sized film has been perfected.

Dr. R. A. Millikan, now director of the California Institute of Technology at Pasadena, was awarded the 1922 Nobel prize for physics in recognition of his isolation and measurement of the electron.

The world's shortest electric waves were produced by Drs. E. F. Nichols and J. D. Tear. They were one fiftieth of an inch in length and are equal to shortest of heat waves; thus the gap in the spectrum between heat and electro-magnetic waves was closed.

Medicine

New disease "tularemia," rarely fatal, transmitted by bites of stable-flies and bedbugs from small animals to man, found by U. S. Public Health Service to be widely distributed in the United States.

Artificial fat, "intarvin," for use in the prevention of acidosis in diabetes invented and manufactured in New York.

The first recorded operation on the valves of the heart was performed by Drs. E. C. Cutler and S. A. Levine, of the Harvard Medical School. The patient recovered.

Bacillary dysentery was reported cured by bacteriophage treatment.

Dr. Simon Flexner, of the Rockefeller Institute, announced by radio the discovery by Drs. Peter K. Olitsky and Frederick T. Gates of Bacterium pneumosintes, the germ held responsible for influenza.

Bacteria capable of causing tooth decay have been discovered and isolated by Dr. F. E. Rodriguez, U. S. Army Dental Corps.

Ethylene gas was discovered to be effective anesthetic by Drs. A. B. Luckhardt and J. B. Carter, of the University of Chicago.

A substance similar in effect to insulin has been extracted from yeast, by L. B. Winter and W. Smith, in the Biochemical Laboratory at Cambridge.

Tubercle bacillus has been found by Drs. E. B. Brown and Treat B. Johnson, of Yale, to be an animal instead of a plant.

Acetylene gas used as anesthetic in Germany.

Paresis treated by giving patients malaria.

Invention of sulfarsphenamine, a new drug for treating syphilis, was announced by Drs. Carl Voegtlin and J. M. Johnson, of the U. S. Public Health Service.

Tryparsamid, a new arsenical drug remedy for general paralysis and locomotor ataxia, was reported to the American Medical Association by Drs. W. F. Lorenz, A. S. Loevenhart, W. J. Blackwen and F. J. Hodges.

The Army Medical School developed rapid and easy way of purifying drinking water with iodine.

Drs. F. G. Banting and J. J. R. Macleod, of the University of Toronto, were awarded the 1922 Nobel prize for medicine in recognition of their discovery of insulin, the specific for diabetes.

A parasite which causes disease in both plants and man has been discovered by Dr. Richard P. Strong, of the Harvard Medical School. In order that it may affect man it must pass through an insect and a lizard as intermediate hosts.

Geology

The U. S. Coast and Geodetic Survey announced that studies of earth movements in California show varying and opposing motions, and their study may lead to prediction of earthquakes.

Fossil ancestors of American dinosaurs and dinosaur eggs discovered for the first time in Mongolia by the Third Asiatic Expedition of the American Museum of Natural History.

Japan suffered the most disastrous earthquake of modern times.

Exploration, Archeology and Anthropology

The Canyon of the Colorado River was surveyed by a U. S. Geological Survey party.

Carlsbad caverns in New Mexico were discovered and explored by the U. S. Geological Survey.

Announcement was made of ten year program of archeological research in the Mada district of Yucatan by the Carnegie Institution of Washington.

Discovery by Smithsonian Institution of mysterious tribe of Indians in northwest Labrador, apparently unrelated to neighboring tribes.

Knud Rasmussen, Danish explorer, began the study of Eskimo in northernmost Canada.

Dr. Eugene Dubois, of Amsterdam, permitted inspection by American scientists of bones of Java ape-man, discovered by him 30 years ago.

Deformed prehistoric skull believed to be earlier than any known Indians and to show relationship with South American tribes, was found near Noel, Missouri.

Radio and Engineering, Aeronautics

Boiler and turbine using mercury vapor instead of steam put to practical use in Hartford, Conn., electric power plant.

Device invented for feeding air to airplane engines at atmospheric pressure regardless of altitude, making possible higher records in altitude flights.

Empty airplane flown under radio control by another plane at Dayton, Ohio.

U. S. Hydrographic Office announced "double-tracking" of the Pacific Ocean to avoid traffic accidents.

C. Francis Jenkins, Washington inventor, sends photographs five miles by radio.

The first rigid airship to be built in America, the Navy fleet airship U. S. S. *Shenandoah*, formerly known as the ZR-1, was successfully launched and tested, using helium gas for inflation.

The success of night flying and carrying of mails was demonstrated by five day test by the Air Mail Service in which mail was transported across the continent both ways in from 27 to 30 hours.

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(cf.—Osborne & Harris, Jr. Am. Chem. Soc., 25-IV. 346)

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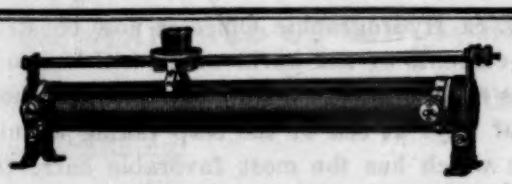

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A new official speed record of over 4 miles a minute, 243.67 miles an hour, was established by Navy aviators at the Pulitzer races, and subsequently 266.6 miles per hour on a straight-away course was achieved.

LIFE HISTORY OF CHIGGER

ANOTHER chapter in the life of the chigger has been observed and the eradication of this summer pest brought closer by a discovery of Dr. H. E. Ewing, of the Division of Insects of the U. S. National Museum. Dr. Ewing reports that he has found the hitherto unknown full grown form of the common chigger, together with strong indications that the rabbit is largely responsible for its spread.

The adult chigger has long been known to entomologists as Trombicula, a harvest mite which lives in the soil. In finding this mite most frequently associated with the tiny red larval form familiar to the picnicker in the woods, Dr. Ewing suspected its identity. He collected a number of Trombiculae and bred them in captivity. The resulting young were the characteristic red chigger about one fiftieth the size of the adult mite, which is orange-red in color and about as large as the head of a pin.

From the chigger stage of life the insect passes first into a nymph stage for a few weeks and then to the adult stage. The insect lives about ten months in the adult stage and is almost amphibious, requiring a great deal of moisture. Dr. Ewing plans to attack these mites in experiments at the Pennsylvania State Forest Camp near Stone Valley, Huntington County, Pa. By raking over the soil, letting it dry, and by using sulphur, he hopes to free the site from chiggers.

The indications are that there is but one generation a year, and if the adults can be exterminated by depriving them of moisture, the chigger may be checked. Another possibility of control is by getting rid of the rabbits. Although it is not definitely known yet whether rabbits are the only animal which is the natural host of the chigger, the indications are that it is the principal one.

Dr. Ewing tried raising chiggers on men, field-mice and other animals. After swelling up with a full meal of the blood-serum of man, and most other animals, they drop off. Chiggers never bury themselves under the human skin as was formerly supposed, but merely attach themselves by their mouth parts to the outer skin.

The chigger is not known to carry any disease to man in this country, but the Japanese chigger is held responsible for transmitting the very serious and prevalent "flood fever" of that country which is similar to the Rocky Mountain spotted fever in this country.

AN INTERNATIONAL AUXILIARY LANGUAGE

Science Service

A MOVEMENT to form a strong popular organization devoted to language in general and international auxiliary language in particular was reported to the American Association for the Advancement of Science by its Committee on an International Auxiliary Language.

One of the chief aims of the proposed International Auxiliary Language Association would be to secure adequate support for thoroughgoing scientific study of linguistic problems by the most competent experts and institutions. Preliminary steps toward a permanent organization have been made in meetings at New York and the international language problem is being studied in universities and private schools in New York City.

In a program devoted to international language, Joseph Bartlett, instructor in French at Antioch College, told how Esperanto is being used among the blind. Mr. Bartlett, who is himself blind, is actively engaged in working among the blind in all parts of the world through the use of Esperanto. Esperanto books for the blind are proving especially important in Brazil, because of the small number of Portuguese books in Braille.

J. W. Hamilton, of St. Paul, Minn., presented the possibilities of a simplified form of English, called Cosmo-English that has proved especially useful in teaching foreigners.

"The modern world of science, technology and commerce has become truly cosmopolitan," said Eugene F. McPike, of Chicago, in presenting a paper on "Interlanguage." "Knowledge is without nationality. Trade is international. But the different peoples are in great need of a common medium of inter-comprehension. And this they may wish for and obtain without departing from patriotism or imperilling national safety. Nor do they have to surrender any of their priceless treasures of achievement."

ITEMS

Science Service

A COMPLETE diet may be built around a quart of milk as a nucleus, according to Dr. Alonzo E. Taylor, director of the Food Research Institute of Stanford University and member of the Food Administration during the war. Using milk instead of water it is possible, Dr. Taylor said, to make a loaf of bread that contains all elements and vitamins needed for health and nutrition, if a few additional substances are mixed with the dough. The organs of animals make better balanced rations and include more vitamins than muscle tissue.

THE U. S. Hydrographic Office is now constructing a chart of currents of the world which will "save millions of dollars each year for the owners and will shorten the number of days at sea of the ship taking advantage of the route which has the most favorable currents." To aid this work, Navy Department officials have requested all captains to throw over bottles containing drift report papers every four hours during their voyages. When picked up and reported these papers will give data for the chart.

FORECASTS of wheat production this year in sixteen countries of the Northern Hemisphere is about 1,878,000,000 bushels compared to 1,754,000,000 bushels last year.

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NEW HAVEN, CONN.

SCIENCE NEWS

A DISTANT UNIVERSE OF STARS

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THE most distant object seen by man, another universe of stars, has been discovered and measured. Photographs made at the Harvard Observatory show that a faint and nameless luminous haze in the sky in the constellation of Sagittarius, the Archer, is another universe like ours, although perhaps smaller. Announcement to this effect will shortly be made in the bulletin of the Harvard Observatory by Dr. Harlow Shapley, director.

It takes light a million years to travel from the new universe to earth, Dr. Shapley estimates from his photographs. So far as is known, this is the most distant object ever seen by the eye of man. The most distant stars and clusters or nebulae in the universe known prior to this measurement are only about 250,000 light years away. The new universe is six quintillion miles away.

This object, known to astronomers only by its number in star catalogues, N.G.C. 6822, was first observed many years ago by the late Dr. E. E. Barnard, but only recently have pictures been made of it by the 100-inch reflecting telescope at Mt. Wilson, the largest in the world, and it is these photographs which have made possible the identification of this cloud of stars as a universe like our own. It is similar, these pictures show, as do others taken by Dr. Perrine, of the Cordoba Observatory in the Argentine, to the Magellanic Clouds, faint patches of light in the sky of the Southern Hemisphere, first seen by Magellan and now recognized as great stellar systems distinct from the Milky Way and our own stellar system although much smaller than it.

The study of the photographs made at the Harvard Observatory shows that N.G.C. 6822 covers an area in the sky less than one thousandth that covered by the large Magellanic Cloud. But this difference in size, as well as the extreme faintness of N.G.C. 6822, can be accounted for by its much greater distance in space. The photographs show that its most brilliant stars are little, if any, brighter than magnitude eighteen. It is only because thousands of stars are packed closely together that the object could be seen faintly in Barnard's telescope.

The angular dimensions and the brightness of some of the nebulae that belong to the new cloud have been estimated on the Harvard photographs and compared with similar objects in the Magellanic Clouds. Estimates of the distance of N.G.C. 6822 will be made more accurately when the variable stars found at Mt. Wilson have been thoroughly studied.

But as the matter now stands, this faint glowing haze, not to be seen with the unaided eye, hardly a pin-head of light in a telescope of moderate power, is now known to be far beyond the limits of our own universe of stars, or, as astronomers call it, "our galactic system," from the fact that it is bounded by the Milky Way or Galaxy. The greatest estimate of the diameter of our universe is 350,000 light years, and N.G.C. 6822, the faintest output of infinity captured by the mind of man, is three times as far away.

The constellation Sagittarius, in which it is found, is now too near the sun to be visible. It can be seen during the summer, the constellation being the next to the east of Scorpio, the familiar "kite" of the southern sky in summer and containing the great red star, Antares.

SELECTION OF IMMIGRANTS

Science Service

NUMERICAL limitation and careful selection of immigrants, with a quota provision based upon the census of 1890, are advocated in the report of the Committee on Selective Immigration of the Eugenics Committee of the United States, made public to-day by Professor Irving Fisher, chairman of the Eugenics Committee.

Immigration is a long-time investment in family stocks rather than a short-time investment in productive labor, is the key-note of the report. A system of consular certificates for intending immigrants, based upon inspection abroad, mental tests for all with a score more than equal to the average American intelligence as a requirement for admission, and severe restriction of the present system of bonding aliens admitted on appeal, are also advocated.

A conviction that the census of 1890 should be used as the basis of any percentage law has been growing rapidly. Since there were fewer southeastern Europeans here in 1890 than in 1910, this provision would decidedly cut down the number of such immigrants. Immigrants from northwestern Europe furnish us with the best material for American citizenship. They have higher living standards than other immigrants, average higher in intelligence, are better educated, more skilled and better able to understand our form of government. A percentage limitation based on the 1890 census is sound American policy based on historical facts.

It is not a question of racial superiority of northwestern Europeans or of racial inferiority of southeastern Europeans. It is simply a question as to which of these two groups of aliens as a whole is best fitted by tradition, political background, customs, social organization, education and habits of thought to adjust itself to American institutions.

Experts have told us that had mental tests been in operation, and had the "inferior" and "very inferior" immigrants been refused admission to the United States, over 6,000,000 aliens now living in the country, free to vote, and to become the fathers and mothers of future Americans, would never have been admitted. It is high time for the American people to put a stop to such degradation of American citizenship.

The report relates the findings of Dr. H. H. Laughlin, assistant director of the Eugenics Record Office, who made a study of the "socially inadequate" groups in 445 institutions for defectives and criminals, and who reports that 44 per cent. of this institutional population

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was either foreign born or had one or both parents foreign born. He also states that the immigrants from northwestern Europe, on the whole, contribute far less in proportion to this defective population than do those from southeastern Europe.

The original argument for the percentage law was economic. The fundamental reason for its continuance is biological. Mental tests are demanded of all immigrants.

No alien should be admitted who has not an intellectual capacity superior to the American average. Aliens should be required to attain a passing score of the median army Alpha test, or the corresponding score of other approved tests; these tests to be given in the native tongue of the immigrant. Aliens whose family history indicates that they come of unsound stock should be debarred.

Since, according to the report, a large percentage of bonded aliens admitted on appeal have violated their bonds and remain in this country, many of them as public charges, it is urged that aliens should be admitted on appeal over the heads of the medical examiners only in very rare and exceptional cases, and in such cases, cash bonds in substantial sums should be required.

Requirements of consular certificates to be made essential to admission should include a certificate from the local police that the intending immigrant had never been convicted of crime other than a political one. Certificates are advocated on the ground of both efficiency and humanity in that they would prevent the distressing scenes when immigrants are separated from their families and turned back at the port of entry.

Members of the Committee on Selective Immigration, presenting this report, include Madison Grant, chairman; Robert DeC. Ward, Charles W. Gould, Lucien Howe, Albert Johnson and Francis H. Kinnicutt.

MAGNETIC IRON DEPOSITS IN RUSSIA

Science Service

THE largest deposits of magnetic iron ore known to man have been discovered in Russia through the visit of Professor Dr. P. Lasareff, director of the magnetic division of the Physical Institute of Moscow, who is in this country as the guest of the American Society of Zoologists.

Lying near Kursk in European Russia, about midway between Moscow and Crimea, they extend for 150 miles, and at one point are 10 to 20 miles wide. The deposits take the form of a great subterranean mountain with its peak 450 feet under ground.

Magnetic observations made primarily for the advancement of science are responsible for the discovery.

For fifty years the compass needle has been known to act strangely in the vicinity of Kursk. The vertical dip at one point was over three times as great as that at the magnetic north pole where the earth's magnetism is felt most strongly.

In 1919 while civil war was still in progress in that region, Professor Lasareff, using only instruments constructed in the laboratory at Moscow, began a magnetic survey of the area for the Russian Academy of Sciences of which he is a member. Investigations continued during the summers following, and gravitational measurements were added to the magnetic.

To measure the force of gravity, Professor Lasareff used the Eotvos balance, a very sensitive instrument invented in Germany, that will detect very small changes in gravity caused by masses in the earth's crust. It is said that this new device is so sensitive that it will detect a man thirty feet away.

Combining the gravitational and magnetic observations, Professor Lasareff was able to map the deposits of magnetic iron ore before they were discovered.

Diamond and churn drills were set at work at points designated and the huge ore body of magnetite was actually found. It lies about 450 feet under the surface and already the drills have penetrated over 500 feet without any sign of its exhaustion. The top portion of the deposit analyzes 40 to 45 per cent. iron, but deeper portions run over 50 per cent. So colossal is the deposit that Professor Lasareff would not attempt to estimate the quantity in tons. The next largest deposit known is in Norway and has a length of only about six miles.

After the steel churn drilling tool had penetrated the deposit of ore for about 100 feet it became so highly magnetized that it would attract and hold ten to twenty pounds of iron.

This summer Professor Lasareff will make an exploratory trip into Siberia and the same methods of investigation will be used.

Professor Lasareff believes that with the possible exception of the United States and Canada, Russia is the land of greatest promise for future natural resources.

HYDRO-ELECTRIC POWER

Science Service

HYDRO-ELECTRIC power development has entered into an era of unprecedented expansion, says a report on the subject to appear in the next issue of *Power*. Applications involving an estimated installation of 21,500,000 horsepower, permits and licenses for 7,500,000 horsepower, and 2,400,000 horsepower built or building is the three year record of the Federal Water Power Commission. Three years ago the aggregate installation of all water-power plants in the United States amounted to only 9,000,000 horsepower.

The largest project started last year was that of the Quebec Development Co., at Lake St. John on the Saguenay River, Quebec, Canada, where a total development of 1,200,000 horsepower is projected. The first development will be only 500,000 horsepower. Another large project is that of the Susquehanna Power Co., which will develop 360,000 horsepower along the river of that name. The West Virginia Power and Transmission Co. has a permit to begin work on the Cheat River in West Virginia which it is thought may yield 600,000 horsepower.

The tendency generally is said to be toward larger and larger units. A unit of 70,000 horsepower was put into service at Niagara Falls, and according to expert engi-

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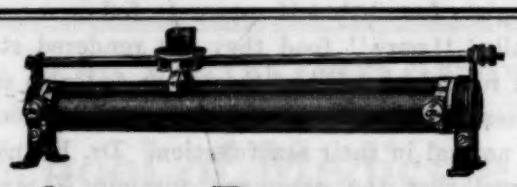

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neers, plans for 100,000 horsepower units are on the drawing boards. It has been shown that workmen who direct the greatest amount of power receive the largest wages, the greatest average daily wage being in the United States where the *per capita* production of horsepower is greatest. To produce 70,000 horsepower by steam would require the continuous work of 1,500 men, from the time the coal was mined until it was fired under the boilers.

The world's available water power is calculated as about 440,000,000 horsepower. Nearly half of this is in Africa which has resources estimated at 200,000,000 horsepower. Seventy-five million horsepower are awaiting development in Asia, while the resources of Europe as 45,000,000 horsepower. Although the water power resources of all North America are only 60,000,000 horsepower, the development up to the present on this continent has been 53 per cent. of the total development in all the world.

PHOTOGRAPHS OF THE INNER BODY

Science Service

By the use of radium emanation added to blood serum, Drs. A. Kotzareff and L. Weyl, of Paris, have been able to obtain photographs of cancers inside the body, according to the report of the Paris representative of the American Medical Association. If confirmed, this new method gives promise of having far reaching effects on the clinical detection and treatment of cancer and other new growths.

The new method involves withdrawing from the body a certain amount of blood. From this blood, the serum is obtained. To this blood serum, a definite dosage of radium emanation is added. The radium treated blood-serum is then injected into the body. The radium emanations tend to locate in the most rapidly growing tissues, such as tumors of a malignant character like cancer. When a photograph of the body is made, the presence of the radium emanation manifests itself on the photographic plate.

When this method was applied to a pregnant guinea pig, it was found that after a certain period of time the radium emanations located in the embryo and disappeared from the remaining tissue. In the same way, it was found the emanations tend to locate in cancer and other rapidly growing tissues.

Medical men here are awaiting the results of using this new method in a sufficiently large number of verified human cancers to confirm the favorable experiments on animals.

MEASUREMENT OF THE SUN'S HEAT

Science Service

At La Quiaca on the northwest boundary of Argentina where, at 11,000 feet above sea level, the sun's rays beat down on a desert mountain region out of clear skies, the Argentine government will soon begin meaesurement of variations in the sun with a view to their use in practical weather forecasting. William H. Hoover, of the Astrophysical Laboratory of the Smithsonian Institution, will leave New York on January 12 for Buenos Aires to install and operate the necessary apparatus.

There are two other stations now in operation making similar measurements. One of these is the Smithsonian station on Mount Montezuma, in Chile, and the other is located near Wenden, Arizona, on Mount Harqua Hala.

Indications have been found at these stations that weather is influenced in some way by variations in solar radiation. The new station will undertake experiments to determine the value of such variations for actual weather prediction. To measure accurately the changes in the amount of heat sent out by the sun, it is necessary to measure the radiation outside the atmosphere or the amount of heat which would reach the earth if there was no air on it.

To do this, the amount of sun's heat falling upon one square centimeter of the earth during the course of one minute is measured at different times of the day when the air mass is different. When the sun is overhead the absorption by the air is least, and it is greatest when the sun is near the horizon. These differences are plotted in the form of a curve and from this data the amount of radiation outside the atmosphere is calculated.

ITEMS

Science Service

One more step toward the isolation of the new vitamin X that controls reproduction has been taken by Drs. Herbert M. Evans and Katharine Scott Bishop, of the anatomical laboratory of the University of California. These physiologists found that if rats were fed on a certain diet of so-called "pure" food they are rendered sterile and will not reproduce. When they were fed also some such substances as lettuce, wheat embryo, alfalfa leaves, they became normal in their sex function. Dr. Evans has now determined that the substance, vitamin X, can be extracted from favorable food by alcohol and ether and that these extracts cure animals of proved sterility. That male rats as well as female are made sterile by lack of vitamin X has also been proved by laboratory work just completed.

Epidemics in Russia showed a marked improvement during the first four months of this year, according to a report just issued by the Health Section of the League of Nations. No cases of plague have been reported since February and only a few isolated cases of cholera have been notified. Increasing incidence of malaria is probably the most serious feature of the present situation in Russia. Over a thousand cases of malaria were reported during three weeks in Moscow alone.

Amateur radio sending stations must remain quiet between 8 and 10:30 P. M. each evening and during local church services on Sunday morning, according to a Department of Commerce regulation just issued. But the governmental prohibition was anticipated by the national organization of radio amateurs, the American Radio Relay League, which has recommended to its members silent hours between 7:30 to 10 P. M. ever since broadcasting became popular.

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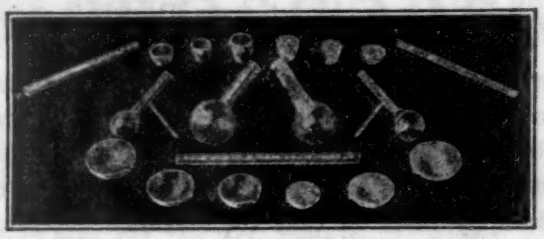

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SCIENCE NEWS

TELEGRAPHIC REPORTS TO THE DAILY PRESS ON THE CINCINNATI MEETING

By Dr. Edwin E. Slosson
Director of Science Service

The energetic and systematic attacks of the Fundamentalists on the teaching of evolution throughout the country have at last aroused the scientists to make their position plain to the public. An emphatic declaration on the question was made by the retiring president of the American Association for the Advancement of Science, Prof. J. Playfair McMurrich, of the University of Toronto, in his address at the University of Cincinnati. In his survey of the work of the association during the seventy-five years of its life he showed how much biological research owed to Darwin, but he explained that the idea of evolution did not originate with Darwin nor is it limited to his doctrine that natural selection is the main causal factor in the transmutation of species.

"The biological world of to-day does not ascribe to that factor the importance that Darwin gave it," Professor McMurrich said. "Its action can not be denied, it is self-evident to any observer of Nature's ways who finds 'that of fifty seeds she often brings but one to bear.' It plays an important rôle in the suppression of the unfit rather than in the survival of the fittest, but it can act only on variations sufficiently pronounced to determine life or death. It has been shown in several cases that what seem trivial variations may, under certain conditions, lead to fatal results, but even admitting these, it is difficult to believe that many of the minute differences that distinguish species have selective values. Natural selection acts effectively in the perpetuation of species, but it does not originate them and to that extent the modern biologist may depart from Darwin's standpoint. Darwin was looking for the origin of species, the modern biologist goes a step further and is looking for the origin of variations and the mechanism of heredity, problems far beyond Darwin's times. But he stands on the foundation built by Darwin, since the whole structure of modern philosophy rests on that foundation."

The new knowledge of the carriers of inheritance and the still newer knowledge of the influence of the secretions of the internal glands on bodily structure and processes have opened the possibility of getting at the causes of variation and even controlling them in a way that Darwin could not have conceived of.

At the conclusion of his address the University of Cincinnati conferred the honorary degree of LL.D. upon Professor McMurrich for his services to science and education.

Dr. Herman L. Fairchild, the veteran geologist of the University of Rochester, also protests against the attitude and action of the Fundamentalists in the following unmistakable terms:

"The object of the association is to bring forth truth and to set forth the truth—to discover and to proclaim the phenomena of the cosmos. The educational function, the advancement of science by the diffusion of knowledge, has not been undertaken in an active and systematic way. And the need is pressing for popular and general scientific education. Not only are many millions of people in this land of education ignorant of elementary science, and being served with sensation instead of fact, but to the multitudes the theories and truths of science are repugnant. Millions in America are kept in mental thraldom by ignorance and superstition. Old Hebrew folk-lore and a cosmogony borrowed from ancient Chaldea are reverenced as divine revelation, and many of its devotees assume that the Lord dictated to Moses in the English language. The same spirit of bigotry and intolerance that burned Giordano Bruno and persecuted Copernicus and Galileo is yet with us here in America, and seeks to dominate instruction and legislation. The truth has great need of fearless champions and forceful leaders. And as the spokesman for organized science in America the American Association should assume leadership in a crusade against the foes of knowledge."

Why is it that people who live in countries having much the same natural advantages in the way of climate and resources differ so widely in character and achievements? This is the question which Professor Ellsworth Huntington, of Yale, undertook to solve in his presidential address before the Association of American Geographers in session on December 28.

He found the answer in the principle which Darwin made the basis of his theory of evolution, that is, natural selection.

"Such selection is obviously taking place to-day," he said, "and through its agency the character of a people appears sometimes to change so rapidly that racial character seems to be plastic rather than fixed as is so often supposed."

Professor Huntington found abundant evidence in support of his view during his recent travels in Australia and Asia. The Australians are remarkably homogeneous, extremely prosperous and enjoy phenomenally good health. The death rate is lower than in any other country except New Zealand. Even in semi-tropical Queensland the British stock thrives. This he attributes to the fact that the country was settled by immigrants who in health, industry, initiative and optimism were superior to the average Englishman.

New England is another example of such selective emigration. The Puritans were people of exceptional independence and courage and then the rigors of the voyage and pioneering period weeded out the weaklings.

"It was this inheritance," Professor Huntington said, "which made New England the birthplace of the modern form of democracy, of universal education and of many other new ideas, and which to-day causes people of old New England descent to occupy positions of influence far out of proportion to their numbers."

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Another phase of man's social evolution was discussed by Professor Hervey W. Shimer, of the Massachusetts Institute of Technology. He traced human instincts back through the geological ages for millions of years. The three primary impulses, those for self-preservation, nutrition and reproduction, man shares with all creatures, even the lowest, such as the worm and the jelly fish. The parental instinct must have appeared in the Mesozoic era or earlier, say some twenty million years ago, for many fishes and reptiles manifest care for their offspring.

Later in time some mammals began to associate themselves in packs and herds for the betterment of protection, food supply and care for their young. This involved even in its primitive forms obedience to leadership and subordination of individual impulses that do not conform to the common will.

"Any decided originality in conduct," said Professor Shimer, "would be obliterated since it would tend to expose not only the individual, but the entire herd to danger. All members of the herd would thus develop the same fixed mental reactions to all ordinary happenings. In man we recognize the herd instinct in many characteristic reactions. Decided originality in conduct is looked upon with suspicion. What the majority say or do is right. He has fixed ideas, that is, his mental reactions are governed by what those individuals he most associates with, or the literature read by him, say is proper. The herd is his normal environment, that is, he is fearful of solitude, physical or mental. He is remarkably susceptible to leadership. He is subject to the passions of the pack, as is seen in mob violence and heresy spasms. He is more sensitive to the voice of the herd than to any other influence; it can inhibit or stimulate conduct, courage, energy, endurance."

"The results of my investigations of the high altitude rocket make reasonably certain the opening of a new field of scientific endeavor, namely, the investigation of space," said Professor R. H. Goddard, of Clark University, on December 28.

Some five years ago the reading public was interested in rumors of a project for a rocket which might pass from the earth to the moon. Little has been heard of the idea since, but Professor Goddard has been quietly continuing his researches, and now he tells that "there is but one more step to be made before I can prepare a model for flight and this step does not involve any unknown factors."

A speed of six miles a second would be sufficient to free a projectile from the attraction of the earth, and, once free, it might go on until it struck the moon or something else. The highest velocity yet attained by a cannon ball is about a mile a second, but a rocket would have the advantage over a projectile in that it would get lighter as it rose from the loss of the explosive that propels it.

By loading his rocket with smokeless powder, Professor Goddard is able to give with the stream of hot gases expelled from the rear a velocity of one and a half miles per second. When the rocket got above the atmosphere it would find traveling easier and the downward force of gravitation would continuously lessen. So to reach any height does not seem impractical.

Many years ago Jules Verne told of a hollow cannon ball that carried passengers from the earth to the moon, and recently Professor H. Oberth, of Roumania, suggested the possibility of a passenger-carrying rocket. But Professor Goddard is more modest and talks only of the advantages of taking photographs and making meteorological records at altitudes hitherto beyond the reach of man.

While electronic physicists from all over the country were reporting new complexities in the behavior of atoms, John Mills, of the Western Electric Company, was telling the engineers attending the American Association for the Advancement of Science about the marvelous simplification which has resulted from modern physical research. The basic facts are known, he said, and the advances in our knowledge promise to lead to important industrial applications.

Knowing the atom is like knowing your own automobile. You know its main features and its functions, but you can learn something new about it each trip you make, particularly if you have been acquainted with it for a long time. That is the way the physicists are getting along with their atom which they started running about 1897.

They know its main features—a tiny central nucleus of specks of electricity, protons and electrons. And about that nucleus a few electrons move with incredible speed in orbits like planets about a sun. All the present excitement among physicists has to do with the behavior of these planetary electrons. Something is always deranging their orbits.

Ever since Bohr, in Denmark, advanced the theory that some of these orbits were more natural or stable than others the physicists have been busy deranging the orbits, throwing the atom out of gear and seeing what happens. And they can see very well, because the atom tries to return to normalcy. Every time it does, or every time it comes a little nearer, it shoots out a quantum of energy—and whatever is struck by that quantum knows it, for it sees the light. Physicists photograph the light, and then think up the explanation of what happened inside the atom when the electrons tried to get back to their normal orbits.

We are just beginning to get acquainted with such newcomers as "electrons" and "protons," and now we are introduced to another minute member of the same family, the "etherion," which Professor A. P. Mathews, of the University of Cincinnati, says is the ultimate unit of light and electricity. He rejects the prevailing theory that light consists of waves in a jellylike substance called the ether. Light, he holds, is not radiated in waves, but in rays. The ether he conceives as made up of minute spheres—etherions—which are revolving at such high speed that their surfaces have a velocity of 186,000 miles a second. When one etherion gains energy of rotation it becomes an electron of positive electricity, and the neighboring etherion that has been robbed of this energy becomes a negative electron.

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Professor Matthews said: "An electron is therefore simply a wave of light too small for transmission and going round and round in one place. Light is then the basis of matter, since the electrons out of which all matter is made are simply imprisoned light."

Motion picture photographs of the tracks of the nucleus of the helium atom traveling at a rate fifteen thousand times greater than that of the fastest rifle bullet were exhibited on December 29 to the American Association for the Advancement of Science by Professor W. D. Harkins, of the University of Chicago.

One of the forty thousand photographs taken in the course of his investigations showed the collision of the nucleus of a helium atom moving at this speed with the nucleus of an argon atom which is much heavier. The force of this blow was the most terrific ever recorded by any direct experimental means for the energy of this helium projectile on account of its immense velocity was some two hundred and twenty five million times that of a rifle bullet in proportion to its mass. Yet the argon nucleus was not broken up by the shock for its track beyond the site of the collision is not double but single. The nucleus is the central sun around which the planetary electrons revolve at high speed. Although the nucleus of an atom is so small that it would take a million times a million of them laid in a row to reach an inch, yet their motion can be made visible and photographed by passing them through damp air strongly lighted from the side. When the air is suddenly cooled by expansion, the flying atomic fragments leave luminous tracks of condensed water vapor. Ordinarily the path is straight, but some of the photographs show that the helium nucleus has been deflected or forced to rebound by contact with the nucleus of one of the atoms of the gas.

Equally spectacular experiments with atoms and electrons were exhibited by Dr. Willis Rodney Whitney, of the General Electric Company, in his lecture on "The Vacuum, There is Something in It." He laid a layer of thorium, one atom deep, on the surface of a tungsten wire in a lamp bulb and then drove it off by molecular bombardment, all in a few minutes before the audience. He showed how a stream of electrons, the atoms of electricity, could be retarded, deflected and then repulsed by the simple charging of a grid with the same sort of electricity by pointing at the tube with a resinous rod rubbed by his hand. He demonstrated the wireless transmission of electrical power through space. Although a lamp bulb is supposed to be exhausted to a vacuum, yet it still contains as many gas molecules as there are people in the world. He charged toy balloons with electricity by rubbing them on his hair, and then discharged them instantly by X-rays. The X-rays are now used not only for photographing our bones but also for detecting synthetic silk from natural fiber and for testing the strength of metals by revealing their crystal structure.

The new conception of the atom as mostly empty space with a positive nucleus and rapidly moving negative electrons seems at first to be a less stable foundation for the material universe than our old fashioned notion of the atoms as little hard and solid balls. Yet, as Professor Harkins showed, they can stand incredible blows and as Professor T. C. Chamberlin, of the University of Chicago, explained, in his lecture on the constitution of the earth, the rapid rotation of the electrons in the atom give the stability and elasticity of a gyroscopic top which is greater than any purely static and rigid structure could have. The intense revolutions of the atom create powerful electric and magnetic fields and their polarities afford points of attachment to other atoms and so make up solid bodies. The rotational energy embodied in the earth seems to be many hundreds of thousands of times as great as the vibration energy of the internal heat of the earth, Professor Chamberlin said, and this new view of the constitution of matter profoundly reverses the idea of their relative value hitherto held by geologists. Heat is a disintegrating force, while the revolving electrons on the contrary hold the world rigidly together.

Corn plants suffering from diabetes have been discovered and treated successfully with insulin, Dr. W. H. Eyster, of the University of Missouri, announced to the American Association for the Advancement of Science during a symposium on internal secretions. Several stalks after two or three days above ground gave off an excess of sugar—a condition exactly analogous to human diabetes mellitus—but they were able to utilize their excess of sweetness when they were fed insulin, the pancreatic extract, for the discovery of which Drs. F. G. Banting and J. J. R. Macleod, of Toronto, received the Nobel Prize.

Dr. Eyster and his coworker, Dr. M. M. Ellis, also discovered that insulin is composed of two substances, one of which when administered separately seems to cause rather than cure plant diabetes. The separation of insulin into two portions is effected by membranes such as those on roots and the second portion that does not pass through is a very active growth producer in some cases doubling the size of the corn plants. Dr. Macleod commented on this discovery and declared it to be of great importance.

Dr. Macleod told the story of how two young men, Banting and Best, working in his laboratory all summer solved the problem of extracting from the pancreas a remedy for diabetes. He was not yet ready to call insulin a "cure" for diabetes, but since the islets of Langerhans may be revived and regenerated when partially destroyed, he saw no reason why the temporary relief afforded them by insulin injections might not finally effect a cure. The pancreas has other functions than aiding in digestion and regulating the consumption of sugar, and Dr. Macleod suggested that insulin or some other hormone from this gland may control the migration and deposition of fat.

"It is startling to think that only three grains of thyroid gland extract a year stands between any of us and imbecility," said Professor R. G. Hoskins, of the Ohio State University. "A sluggish, sleepy, band-legged, pot-bellied cretin boy may be restored to normalcy, and his stature increased by several inches through feeding with extract of the thyroid gland."

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of thyroid deficiency. Dr. Hoskins gave some still more startling examples of the potency of glandular extracts that the modern physician has at his command. Adrenalin extracted from the adrenal glands, above the liver, can be detected by its physiological effects in a dilution of one part in one hundred million parts of water.

But this does not compare in power with pituitrin which Professor John J. Abel, of Johns Hopkins Medical School, has just extracted in purified form from the pituitary body in the base of the brain. This can be detected in a solution diluted to one part in a hundred billion parts of water. Such figures are inconceivable to the human mind unless expressed in concrete form. Suppose one ounce of Professor Abel's purified pituitrin were dissolved in so much water that it will no longer produce any effect on a strip of muscular tissue. It would require a six thousand two hundred and fifty mile long string of sprinkler carts, carrying 625 gallons each and traveling two hundred to the mile, to reduce the ounce to impotency. The biologists are now rivaling the astronomers in using numbers that baffle our minds and strain our imaginations.

The pineal gland was surmised by the old French philosopher Descartes to be the seat of the soul, because it was a solitary body in the middle of the brain. But this gland recedes after the age of seven which, as Professor Hoskins remarked, is not comparable with the theology of Descartes. The pineal gland is now held to be a vestige of the third eye of ancient reptiles. Its destruction in childhood results in excessive body growth and premature sexual development, but its latter function is obscure.

"Darwin and Lincoln were born on the same day. If the two infants had been exchanged there would have been no Darwin and no Lincoln. What a man can do is determined by his native equipment, what he does is determined by the circumstances of his life." This is the way Dr. J. McKeen Cattell, newly elected president of the American Association for the Advancement of Science, decided the old question of the conflicting claims of nature and nurture, heredity and environment.

Dr. Cattell was the pioneer in the field of mental tests now so diligently cultivated. In 1885 he made the first quantitative measurements of individual differences in intellectual processes and he now reveals the fact that John Dewey, then his fellow student and since famous as an educator and philosopher, stood highest in the group tested. In that early work on the variation of mental ability, Dr. Cattell used the term "alertness" tests and he still prefers that to the term "intelligence" tests now employed.

And he adds: "I have always held that psychology has to do with the conduct of an individual rather than with his consciousness. We are concerned with what a person does, rather than with what he thinks he thinks, feels he feels or imagines he imagines. It is usually no more necessary for the subject to be a psychologist than it is for a vivisected frog to be a psychologist."

"The proper interpretation of intelligence tests consists in learning what an individual will do in a given situation, what are the conditions leading him to act as he does, how well we can predict this. Our current tests foretell as accurately as an entrance examination or a high school record what a boy will do in college. That is practically important, for it gives a more nearly equal chance to those who have had varying opportunities in the past. Boys from private preparatory schools pass college entrance examinations more readily than those from public high schools, but they do not do so well in their studies afterwards. What is hopeful about the tests is that they predict what a boy can do even more accurately than what he will do."

Dr. Cattell explained that the tests predict that Irish children will not do as well as American children in bookkeeping and stenography, but they do not directly measure the probable success of the two groups in keeping saloons, running Tammany Hall, writing poetic drama or starting rows.

The common belief that children in the rural districts have a superior physical development is contradicted by the results of a three years investigation of children reported by Professor B. T. Baldwin, of the University of Iowa. Another popular fallacy, that children of unusual intelligence are apt to be weaklings and the strong ones stupid is upset by the physical and mental tests carried out in cooperation with Dr. Lewis Terman, of Stanford, in the laboratory schools of the University of Iowa on 640 children of ability forty per cent. or more above the average. The investigators found that "good physical growth and good mental growth go hand in hand, and that superior children mentally are as a rule superior physically."

As scientific consultant for the Cleveland schools, Dr. Baldwin has been able by means of mental and physical tests to cut down the percentage of retardation by half and to save in the last half year fifteen thousand school days for thirty-five hundred pupils, which means a saving of thousands of dollars for the school system.

PACIFIC trade winds will be used in an attempt to blow disease out of the Samoa Islands, according to plans of Dr. Patrick A. Buxton, leader of the expedition of the London School of Tropical Medicine which set sail for the South Seas on November 15. Tuberculosis and other diseases threaten the extinction of the natives of ceptibility may be due to a condition caused by a tiny the Samoa group of islands and it is thought their susparasite carried by the Stegomyia mosquito. This mosquito does not seem to be able to exist where the dense undergrowth is cut down. By cutting airways through the dense jungle so that the Pacific trade winds can blow through it, it is hoped that the insects will be blown away. An intensive attack, which will also include substituting modern cisterns for the hollowed coconut tree tanks, which furnish breeding places for the mosquitos, will be made first on one small island. This island will be an object lesson for the larger islands of the group. The expedition is expected to be in the tropics for two years.

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SCIENCE NEWS

STUDIES OF MEASLES AND SCARLET FEVER

Science Service

THE successful use of a preventive serum for measles has been announced by Drs. George H. Weaver and T. T. Crooks in a report to the American Medical Association on the results of the use of the serum in the Durand Hospital of the John McCormick Institute for Infectious Diseases.

The study was made on 57 children, all susceptible to measles, who were known to have been exposed to the disease. Of these 48 were injected with the serum. All the remaining nine came down with the disease. Of those given the serum treatment, 44 failed to develop the disease, while of the remaining four the measles rash appeared in three in from one to six days after the serum injection.

The main use of the serum seems to be limited to the prevention of the disease when given during the first week of exposure. The Chicago investigators also conclude that babies are naturally immune during the first few months of life, and confirm earlier beliefs that one attack gives relative immunity. A Berlin physician has collected the results of 2,000 cases where serum from the blood of patients convalescing from measles had been injected into the veins of persons exposed to the disease, and has found that it has protected in more than 97 per cent. of all exposures.

The development of a test to determine human susceptibility to scarlet fever has been announced to the American Medical Association by Drs. George F. Dick and Gladys Henry Dick of the John McCormick Institute for Infectious Diseases of Chicago. It is expected to do for scarlet fever what the Schick test does for diphtheria.

The responsibility for scarlet fever has apparently been fastened firmly on a suspected germ, a streptococcus that destroys blood corpuscles. And, more important, the two medical experimenters have taken the first steps toward a method of immunizing against the disease by use of products obtained from the apparently specific scarlet fever streptococcus.

Drs. Dick and Dick recently were able to produce scarlet fever experimentally, using human volunteers as subjects. The disease developed in the volunteers after cultures of hemolytic streptococci were swabbed on their tonsils and pharynx. Using the filtrate from cultures of this streptococcus they have now been able to devise a skin sensitization test that tells whether the person tested is susceptible to scarlet fever.

All convalescent scarlet fever patients showed a negative or only slightly positive reaction to the new skin test. But 41.6 per cent. of persons tested who had not had scarlet fever showed positive skin tests. If this ratio holds generally, it means that less than half of the population is susceptible to scarlet fever.

The filtrate used in the skin sensitization test will not react properly when it is mixed with serum from convalescent scarlet fever patients, and this may lead to a means of prevention of scarlet fever, similar to the antitoxins used in treatment of diphtheria and other diseases.

Progress in the use of a serum for the treatment of scarlet fever has also been reported by Dr. A. R. Dochez, of Columbia University, and Dr. Francis G. Blake, of Yale. Serum from horses inoculated with the hemolytic streptococcus was used in the treatment of scarlet fever patients with promising results.

INJURY FROM RADIUM

Science Service

EXPOSURE to radium radiation for a few hours daily over a long period has apparently been shown to be dangerous to health, says a report of the U. S. Public Health Service. The blood seems to be especially affected, showing a reduction in the number of both the red and the white corpuscles. Blood pressure becomes abnormally low.

These conclusions follow a study made of workers at the U. S. Bureau of Standards who handle radium daily and are exposed to its effects. Practically all the radium sold for medical or scientific purposes in the United States is sent to the Bureau of Standards for measurement. Twelve of the employees of this radium section, five men and seven women, were studied over a period of months. All but two had handled radium for at least six months previous to the beginning of the test. One had been out of the radium section for a year and a half, but before that had been in it for more than six years.

The fact that the employees were exposed to radiation in spite of precautions taken to prevent the rays striking their bodies was demonstrated by the use of sensitive films such as are used for taking dental X-ray pictures. These were worn by the men and women for several days and when developed showed unmistakable evidence of exposure to radiation. The principal areas of exposure were the head, arms and hands.

The probable reason for the effect of the rays from radium on the blood, while X-rays have no such influence, is stated to be that the more penetrating gamma rays of the radium affect the bone marrow, which is known to be the source of the blood cells. While none of the workers observed was invalided during the period of the test, one had just recovered from an illness diagnosed as anemia and showed fewer blood corpuscles than normal, both red and white. Practically all the others showed a tendency to diminution of the blood corpuscles especially of the white ones, which are those concerned largely with immunity from and resistance to disease. Blood pressure was below normal in practically all the workers during the whole time of the study.

As a result of these findings it is recommended that workers in radium should be protected as far as possible by the use of metal screens opaque to the rays; that they

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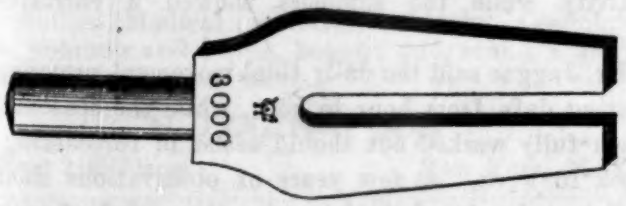

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should be subjected to frequent physical examinations; that they should not be permitted to work more than five days a week with at least a two day period intervening between the two rest days; and that they should have vacations of two weeks, taken at six months' intervals, and spent as largely as possible out of doors. Further investigations are in progress.

AN AUTOMATIC POWER PLANT

Science Service

A GREAT hydro-electric plant which needs no man about the place while it furnishes power to the industries of New England is located at Searsburg, Vt., on the upper waters of the Deerfield River. Excepting for the occasional visit of an engineer, it operates in complete solitude, attending to its duties unassisted, even to meeting whatever emergency may arise.

It is wholly automatic in its control. If serious trouble arises in its mechanism, it shuts down and stays shut down until experts have made things right again. But if the trouble is trifling and of a sort to correct itself, the big waterwheel and generator rest for a time until conditions are again normal, and then start up again turning out their thousands of horse power. Other automatic stations are in operation elsewhere; the idea has been tried out in small units. But the plant at Searsburg is the largest of its kind in the world.

The plant is the uppermost of the seven stations of the New England Power Co. on the Deerfield River. Its turbine, rotating at 360 revolutions per minute, drives a generator having a capacity of 6,500 horse power. The only help from human beings that is required is an occasional looking over and attention to the lubricating system, and remedying of any trouble, or to set the governor mechanism to produce a given amount of power, or to start up the turbine at some predetermined moment.

If the company's dispatcher down in Millbury, 100 miles away in central Massachusetts, decides to tie in the Searsburg power, say at 6 o'clock the next morning, a man visits the station and sets an alarm clock for that hour. When the alarm goes off, the control circuit is closed, the gate of the huge penstock is opened, the water pours through the wheel and the generator begins to convert its power into electric current and deliver it to the high tension wires which stretch along the right of way to the distant distributing station at Millbury.

Or the dispatcher, knowing the flow of water which is to be let down from the company's Somerset reservoir, which impounds the flow of the upper watershed, may decide that the automatic plant shall generate 2,000 or 3,000 or 4,000 horse power, whatever may seem desirable under given conditions. In such a case a dial on the governor is set for that power, which is all that the station will generate until the setting of the dial has been changed.

These are by no means all the human characteristics of the automatic station. If left to itself to run as it wants to, the turbine will start up when water arrives in sufficient volume, and will shut down when the water falls below the efficient limit. Should a bearing become heated the penstock gate closes, in which case the wheel will stay idle until experts come and remedy the trouble. But when generator windings become too warm, the unit shuts down only so long as the temperature remains abnormal. When the windings cool off, turbine and generator run along merrily again.

In times of high water, when the river flow itself is ample and storage water is not a factor, the Searsburg plant runs right along all by itself, day and night, a constant, dependable source of power. It is here that another automatic function is important, the regulation of power generated to the load imposed. When the load falls off the action of the governor causes the supply of water to decrease proportionately, which means the production of a smaller amount of power.

VOLCANIC TIDES AND ERUPTIONS

Science Service

ANNOUNCEMENT of the discovery of daily and monthly tides in the lava in the cratar of Kilauea volcano in the Hawaiian Islands was made in a lecture before the Washington Academy of Sciences, on January 23, by Dr. T. A. Jaggar, director of the Hawaiian Volcano Observatory of the U. S. Weather Bureau. The observatory is located on Kilauea. Dr. Jaggar said the observations might be valuable in predicting future eruptions.

The liquid lava shows a twice-a-day fluctuation in level of from two to seven feet, a daily variation of three to five feet and a monthly shifting of the time of maxi- and minimum level. This would not be the case if the "tides" were due to weather conditions which change irregularly, but it might be due, Dr. Jaggar said, to control by the sun and moon.

The hard lava floor of the crater also showed a daily change in level of about one foot, but the times of maximum and minimum were nearly opposite those for the liquid lava, the high level occurring in the morning in the case of the liquid and after midnight in the case of the solid lava during a period of two months last summer when observations were taken.

Seasonal tilting of the ground on which the observatory stands was also reported, the tilting causing a plumb line shift of from 15 to 25 seconds of arc. Seasons in which this tilting was least showed the least amount of volcanic activity and a decline of the lava column in both Kilauea and Mauna Loa. Since 1919 the winters have shown strong monthly tilts and strong lava activity while the summers showed a corresponding decline.

Dr. Jaggar said the daily tidal movement provides forecasting data from hour to hour, while the seasonal tides when fully worked out should assist in forecasting from week to week. A few years of observations should be sufficient, he stated, to determine the period of eruptivity of Hawaiian volcanoes, and to place it on a quantitative basis.

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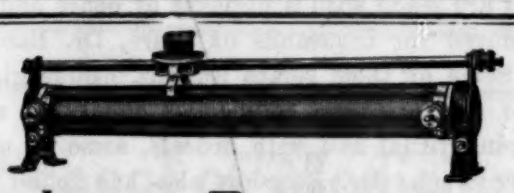

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duce materially the price of the precious metal. An authoritative account of the find and of its possibilities by P. A. Wagner, of the Geological Survey, and T. G. Trevor, inspector of mines, appears in the current number of the *South African Journal of Industries.*

The discovery was made last summer by Adolph Erasmus, a well-known prospector. He was looking for tin at the time, and was, in fact, going over a region that had been repeatedly prospected for both gold and tin without any platinum having been found. The discovery, says the article, "shows how largely blind fortune enters into these things, and how sometimes one discovery leads to another."

The farm on which the discovery was made had been proclaimed as a public gold field in the early days, but when all claims were abandoned it was deproclaimed. Subsequently tin was discovered on it, and a mine of that metal was worked several years until the deposit was exhausted. Mr. Erasmus thought there might be more tin there and proceeded to make a few tests.

Almost the first panning yielded not only a few specks of gold, but a "tail" of grayish white concentrates that lagged behind the gold in the pan. Reasoning that since platinum is the only metal he had heard of that was heavier than gold, and that these residues must be heavier than the gold and therefore probably of platinum, Mr. Erasmus immediately communicated with his principal. Investigation showed platinum present in workable quantities, the first discovery of commercial quantities of the metal in Africa.

Several companies are now exploiting the deposit which is located in the Waterberg district, about 100 miles north of Johannesburg. The lodes are known to extend for a distance of 10 to 15 miles, with many surface outcrops. The ore averages about 9 troy ounces to the short ton, although some samples have yielded as high as 137 ounces. The yield generally is very variable.

Economically, the discovery is of great importance. Although almost indispensable in many chemical operations, and especially desired for further research in the fixation of atmospheric nitrogen, the cost of platinum is very high. More than half the total product is now used in jewelry, since platinum rings and settings have become popular, and the demand from jewelers fixes the price which has risen to about $100 an ounce, or about five times that of gold.

The pre-war price was less than half the present figure. The supply then came chiefly from the Ural mountains, but the war and the revolution in Russia stopped that source to a great extent, and other poorer sources in various parts of the world had to be depended on. South African platinum will, so the authors of this report declare, probably prevent any further rise in price and more probably will help to materially reduce it.

ITEMS

Science Service

COD LIVER OIL is not only good for growing children, it is good for cows and pigs. English scientists have found it to be a valuable cattle food. More than that, it provides cows with the essential vitamin A which then appears in the milk, keeping up the vitamin content when, as in winter, it is not available from natural sources. It has been found that cows fed on cod liver oil do not show an increase of fat in their milk, the milk is no richer in cream, but the amount of vitamin is greatly increased. Cows normally get their supply of vitamin A from fresh grass, but it is absent in dried hay and in grain feeds so that the milk in winter is deficient in this respect and children fed this milk do not get from it the vitamins so necessary to their growth. Cod liver oil feeding solves this difficulty and makes possible the production of milk rich in vitamin at all seasons. Only a small amount of oil is needed, two ounces a day being enough for a cow. Even in larger doses no fishy or oily taste is given the milk.

DISCOVERY of cave drawings made by the black aborigines of Australia, rivaling in interest those found some years ago in the caves of southern France, has been announced by Dr. Herbert Basedow at Adelaide, Australia, as the result of extensive explorations in central and northern Australia, according to dispatches published in London. The older carvings were supposed to be fossils until Dr. Basedow had examined them. A similarity between the system of geometrical and conventional designs and the hieroglyphics of ancient Egypt was pointed out by the discoverer. Bilateral symmetry often indicates the human form, and the line, the lattice and the cross are all used to represent human beings. The cross is the most sacred structure known to the natives and is produced only during their religious ceremonies. The cave drawings are made with a pigment of ochre and fat and have endured for thousands of years, Dr. Basedow believes. Some of them relate legends, others give directions for the initiation ceremonies connected with fire-worshipping ritual and with ordeals, some of which are extremely cruel. Dr. Basedow also has found that the blacks comprise all three of the main cultural divisions established for the fossil men of Europe. They use rough stones as implements just as they find them, or they chip them into some conventional shape, or they grind them to a fine edge as desired.

A NEW water-cooled X-ray tube which will make possible the shortening of the period of radiation of malignant tumors from several hours to less than fifteen minutes, has been developed by Dr. W. D. Coolidge, of the General Electric Co., who has reported on his invention to the American Medical Association. Heretofore, in the treatment of cancer it has been necessary to use tubes with low amperage over long periods of time, the exposure to the rays being in some cases as long as 24 hours. The new tube permits the use of as high as 50 milliamperes to secure a voltage of 250,000, reducing the time of treatment in ordinary cases to less than five minutes. Before releasing the tube for general use, experiments were conducted by Dr. J. T. Case, of Battle Creek, Mich., known as an authority on X-ray treatment. More than 500 tests on animals were made before the method was tried in human cases. Dr. Case says that the use of the new tube is quite safe in the hands of the experienced X-ray worker.

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SCIENCE NEWS

SURVEY OF ALASKAN OIL FIELDS

Science Service

THE first reconnaissance survey of the Navy's largest petroleum reserve, located in northern Alaska on the slopes of the Arctic Ocean, is about to be begun by the U. S. Geological Survey. It will involve a trip across central Alaska in midwinter, the expedition expecting to "jump off" from Tanana into the unexplored and desolate wilderness to the northwards about March 1. The final objective will be Pt. Barrow on the Arctic coast which will be reached after a journey of about 1,000 miles by dog sled and canoe.

The area to be examined, in which the oil reserve is situated, is bigger than the state of Maine, comprising 35,000 acres of practically uncharted wilderness that includes mountain chains and vast silent stretches of tundra. The reserve which was created by executive order last February is an irregular tract that extends for nearly 300 miles along the coast of the Arctic Ocean with Pt. Barrow as its most northern point, and runs inland in places for more than 200 miles. It is thought that all this area may contain valuable minerals besides the oil.

A midwinter start has been chosen because traveling in the north is easier when the snow is still on the ground and streams are frozen. The early start will also give sufficient time to carry through the work. The expedition must be entirely self-sustaining for about six months, requiring the freighting of supplies by dog sled for 400 miles even before the reserve is reached. Supplies weighing more than four tons, including food, instruments and even canoes will be carried.

The route from Tanana will be over the mail trail to the Koyukuk River, a northern tributary of the Yukon, up the Koyukuk to the Alatna, one of its own tributaries, and then 150 miles up that stream to the northern limit of timber where headquarters camp will be established, well within the Arctic circle. From this point the advance party will explore the neighboring mountains for a pass while waiting for the freight sleds to catch up with them.

The whole expedition will then cross the mountains, which form the southern boundary of the oil reserve, and will explore their northern slopes. Spring will then be well under way, the streams will be opening, and the party will divide into two sections, each taking a separate route to the Arctic Ocean, hundreds of miles to the north. This part of the journey will be made by canoe, one party expecting to descend the Meade River, the lower 120 miles of which was ascended and mapped by a geological survey party last summer.

During the last 700 miles of the journey, the expedition will be in a country where there is not a stick of wood as big as a pencil, and it must carry all its fuel which will be kerosene oil. It is hoped to help out the commissariat with game such as moose, mountain sheep, ptarmigan and caribou. Fish and little black bears may furnish additional delicacies, especially for the hungry dogs which are expected to consume at least a ton and a half of food.

The party will be in command of Dr. Phillip S. Smith, geologist, who is familiar with the region just south of the oil reserve, and who is already on his way. The other technical members of the expedition are J. B. Mertie and William T. Foran, geologists; Gerald Fitzgerald and R. K. Lynt, topographic engineers, and several assistants.

EXPLORATION OF NEW MEXICO CAVERN

Science Service

A THOROUGH exploration of the recently rediscovered Carlsbad caverns in New Mexico is to be made. The expedition is to be backed by the National Geographic Society and will be in charge of Dr. Willis T. Lee, of the U. S. Geological Survey, who rediscovered and made the first real exploration of the caverns last summer in the course of investigations to determine whether or not the nearby Pecos River was worth a dam for irrigation purposes.

The caverns have recently been made a National Monument by order of the president. They are believed to be the largest in the world so far as known. Dr. Lee's explorations last summer, which were only of a preliminary character, revealed a single corridor which could comfortably accommodate the inaugural parades of a president, being longer than the distance from the Capitol to the White House and wider than Pennsylvania Avenue.

A chamber of more startling magnificence than any artificial structure would provide an inaugural ballroom half a mile long by many hundreds of feet wide. The ornamentation varies from tiny bamboo-like mazes of slender formations which the weight of a hand will crush to massive stalagmites 100 feet high and double that diameter at the base.

A site for a practicable artificial entrance will be sought by the expedition. The only entrance so far as now known involves a vertical descent of 170 feet, the explorers being lowered in a bucket.

Relics of the early inhabitants of the region will be sought in the cavern which may have been used by them as a home or a place of refuge. Plant life in the neighborhood will be studied as will the vast colonies of bats which are now the only inhabitants of these vast regions of subterranean gloom. These are so numerous that when in the twilight they start forth on their nightly flights, the winged stream pours forth from the mouth of the cavern like smoke from a factory chimney for a space of three hours. All night they flit about and when the first gray streaks of dawn appear above the majestic Guadeloupe mountains they crowd back home again to sleep away the sunlit hours.

VOLCANIC STEAM FOR FACTORIES IN ITALY

Science Service

VOLCANIC steam as a source of power is now in commercial operation in Italy according to a report pub-

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lished here and based upon a paper read by Prince Ginori Conti at a recent meeting of the Italian Association for the Advancement of Science. The principal source of natural steam is in the Volterra region about 40 to 50 miles south-southwest of Florence.

The steam jets and hot water springs of this district which contains about two and a half square miles have been known for centuries, but power development there is relatively recent. Two 3,000 kilowatt turbo-generators of the Parsons type are now delivering a three phase current at 4,000 volts, which after transforming into higher voltages is carried to the neighboring cities of Florence, Leghorn, Sienna, and Piombino.

The natural steam is obtained from iron encased boreholes, 16 inches in diameter and from 200 to 500 feet deep. It issues at an average pressure of two atmospheres and a temperature varying from 100 to 190 degrees Centigrade, friction against the walls of the bore causing much of the heat. Recent borings have released steam at a considerably higher pressure and in quantities up to 59 tons an hour.

The steam contains an average of six hundredths of one per cent. of boric acid, which by the latest process is recovered. Four to six per cent. of gases are also found in the steam, these impurities being over 90 per cent. carbon dioxide with small percentage of hydrogen, helium, hydrogen sulphide, argon, oxygen.

In the latest method described by Prince Conti, who has been most active in the industrial development of this region, all these impurities are separated from the natural steam which is then fed directly into the turbines. Earlier methods were the direct use of the steam in reciprocating engines, and the use of steam derived from the boiling of condensed water from the natural steam. This was boiled by the superheated natural steam and used in turbines in place of the natural product so as to eliminate corrosion of the turbine blades from the impurities.

Boric acid of high purity is recovered by evaporating the condensed natural steam in shallow lead pans, the heat being supplied by the uncondensed steam. When a concentration of about eight per cent. is obtained the boric acid is crystallized out on cooling and is subsequently purified by recrystallization. Ten tons of ammonium carbonate a day are produced from the ammonia recovered in the steam at the works at Castelnuovo.

THE COLORADO BEETLE IN EUROPE

Science Service

THE Colorado Potato Beetle, otherwise and more familiarly known to farmers as the potato bug, has followed in the footsteps of the A. E. F., and established himself in Europe. But, unlike the doughboys, they have no return tickets. So firmly are they settled in France that French entomologists despair of exterminating them. "They shall not pass" might stop the Kaiser's army, but no such slogan worried the fighting Yankee bug who, arriving in France some time during the war, proceeded, figuratively speaking, to "cut himself a piece of cake and make himself at home."

The invasion is looked on with dismay by European farmers. Potatoes form a large part of the diet of the average North European, and as historians well know, it was the abundant potato crops of the war years that helped Germany to hold out so long. Quarantines have been established against France by England and other countries in an effort to keep out the invader, and the Germans are especially on guard against this onslaught on their favorite vegetable.

But the busy bug, which has in the space of fifty years crossed the most of the North American continent and the Atlantic Ocean, is hardly to be held at the Rhine. During the war it was seriously proposed by American entomologists to drop potato bugs from airplanes over the fertile fields of the Fatherland, but the project never came to fruition. Now the bugs have taken the matter into their own hands and having been colonized in France through the great volume of wartime shipments of all sorts, they are already chanting their slogan of "On to Berlin."

But if they cross the Rhine they are not likely to stop at Berlin or anywhere else, but to spread generally throughout Europe and Asia, adding another powerful hazard to the risks run by European farmers and giving another illustration of the way commerce has of not only ministering to the needs of men, but also of being of service to his enemies. The gypsy moth, the white pine blister rust, and the corn borer have been brought to America from Europe, and now the potato bug has travelled back along the ways of trade to return with interest the damage caused his native land by his distant cousins of the insect world.

GIZZARD STONES OF DINOSAURS EXHIBITED

Science Service

RELICS of the internal economy of dinosaurs whose eggs are now articles of commerce, which rival in interest those ancient prototypes of the first syllable of a lunch counter breakfast, are being exhibited by Dr. Willis T. Lee, of the U. S. Geological Survey. They are gizzard stones with which, after the manner of modern birds and fowls who are their linear descendants, these brute members of the first families of America ground up in their stomachs the rough and ready food they swallowed some ten million years ago.

Dr. Lee found these pebbles in the course of his explorations last summer of the oil fields of Wyoming. A bed of red clay lies between two of the oil sands and contains thousands of the pebbles with many fossil dinosaur bones. They are of quartz and agate and vary from less than an inch to more than three inches in diameter. Although irregular in shape they are nicely polished from many years' rolling around in the uneasy dinosaurian stomachs.

These stones are thought to be really gizzard stones from the fact that they are entirely foreign to the geological formation in which they are found and have frequently been found with the skeletons of the dinosaurs, and within the fossil skeletons of some of the aquatic

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(cf.—Osborne & Harris, Jr. Am. Chem. Soc., 25-IV. 346)

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relatives of the dinosaurs. Dr. Lee finds no reason to doubt that the pebbles are gizzard stones except their great numbers and when asked for his reasons said:

"Why not? This morning I had fried dinosaur eggs for breakfast and yesterday roast dinosaur for dinner. In helping my wife to prepare the roast I took several pebbles out of its gizzard. Of course, in these modern times we call them fowls, not dinosaurs. But all wise folks know that fowls are the linear descendants of dinosaurs and since the fowls use pebbles in their gizzards to grind their food, it is not strange that their ancestors did the same. The interesting thing is that the fashion has been so faithfully followed for ten million years."

But another geologist has suggested that these stones may have had an even more striking and peculiar use. Some of the dinosaurs were swamp dwellers. They were huge in size, "bigger than several elephants," said Dr. Lee, and ungainly. So it has been suggested that before wading into the swamp muck where his predatory enemies could not follow, he swallowed a bushel or so of stones for ballast and proceeded to snooze in security. A capsized dinosaur would be out of luck. "This," said Dr. Lee, "is carrying a good suggestion too far." However, it is certain that some of the reptiles that inhabited the open sea had the habit of swallowing stones. Gizzard stones have been found in the chalk beds of Kansas nearly one thousand miles from their probable source.

Incidentally, these gizzard stones have an important economic use. The red clay in which they are found, and which is 50 to 200 feet thick, forms a layer between the lowest and the next to the lowest of the oil sands of the Cretaceous beds of Wyoming. It contains great numbers of the polished pebbles giving a clue to the large extent of the dinosaur population in those days so long ago. Any well driller, says Dr. Lee, can distinguish the clay from the oil bearing sands by its color. Thus in drilling such important structures as the Salt Creek oil field and Teapot dome, the pebble-bearing clay is a recognizable key rock.

"It is an interesting thought," says Dr. Lee, "to consider a hundred ton dinosaur billing over the rocks about his native swamp, and selecting from the worthless material the agates which would take a beautiful polish in his internal lapidary mill, to be handed down to admiring posterity as beautifully finished ornamental stones."

DUST EXPLOSIONS

Science Service

NEW means of preventing disastrous dust explosions were made possible by the government's study of the starch dust explosion at Pekin, Ill., which killed 42 persons and caused over a $1,000,000 damage.

Investigations just reported by David J. Price, engineer of the U. S. Bureau of Chemistry, make clear that this disaster was caused primarily by a small fire from an over-heated bearing of a starch conveyor. The damage from this fire was negligible, but it was sufficient to set off the starch dust which rose when a small starch wagon was dumped into a bin.

If the fire and explosion had been confined to this small bin the damage would have been small, though several nearby workers were burned. The great disaster came from the travel of the explosion through the dust cloud which existed all the way along the conveyors which carried starch from the bin to another building. It seemed unbelievable that the small amount of dust in a conveyor tunnel should have been enough to carry the explosion down through the basement, under ground for a considerable distance to another building, and there to set off the whole packing department. But the evidence was conclusive that the flame did travel in this fashion.

Any dust which will burn in the air may become as dangerous as a high explosive. Government engineers advise separation of buildings where dry combustible dust is handled. They point out that buildings with large widow area are much safer if such explosions are likely to occur, because in case of explosion the windows are blown out and relatively little damage results to the walls and floors of the structure itself.

These results are applicable in any plant where powdered coal, ground starch, cocoa, spice, other fine combustible dust, or even metal dust is produced and handled. In such plants there is as much need for care as in dynamite or powder factories.

ITEMS

Science Service

LEE S. CRANDALL, curator of birds of the New York Zoological Park, in a report to the American Game Protective Association warns that unless the few fortunate possessors of aviary pheasants cherish and increase them during the coming breeding season all species are in danger of becoming virtually extinct. The industry of collecting and distributing wild birds and animals has been badly demoralized by the war, and American breeders can no longer depend upon European importations for supply. The seed stock of many kinds of game birds and waterfowl has become dangerously reduced, and even if it is possible to obtain fresh stock, the newly-imported, wild-caught birds often breed with great reluctance, and years must pass before a prolific breeding strain can be developed.

PACIFIC trade winds will be used in an attempt to blow disease out of the Samoa Islands, according to plans of Dr. Patrick A. Buxton, leader of the expedition of the London School of Tropical Medicine which will set sail for the South Seas on November 15. Tuberculosis and other diseases threaten the extinction of the natives of the Samoa group of islands and it is thought their susceptibility may be due to a condition caused by a tiny parasite carried by the Stegomyia mosquito. This mosquito does not seem to be able to exist where the dense undergrowth is cut down. By cutting airways through the dense jungle so that the Pacific trade winds can blow through it, it is hoped that the insects will be blown away. An intensive attack, which will also include substituting modern cisterns for the hollowed coconut tree tanks, which furnish breeding places for the mosquitos, will be made first on one small island. This island will be an object lesson for the larger islands of the group. The expedition is expected to be in the tropics for two years.

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SCIENCE NEWS

THE NEW HARVARD OBSERVATORY

Science Service

A NEW astronomical station of the Harvard Observatory, equipped with two photographic telescopes, has just been installed on the edge of the nitrate desert of northern Chile to test the atmospheric conditions in that locality, and to watch and photograph the southern stars that can not be studied at the existing stations of the observatory at Cambridge, Mandeville, Jamaica and at Arequipa, Peru.

For more than thirty years Harvard has maintained a southern station in order that its series of celestial photographs might cover the whole sky. After the investigation in 1889 of various sites in Peru and Chile, the branch observatory was located in the Andes Mountains near Arequipa, at an altitude of eight thousand feet. Throughout a large part of the year the astronomical conditions in this high altitude are excellent, and the astronomers working at Arequipa have secured more than a hundred thousand photographs of southern stars. During the Peruvian summer, however, in the months from December to March, a heavily clouded season prevails. The continuity of the photographic record is then so badly interrupted that it has now been decided to test other sites in the hope of finding a favorable place that may be occupied during the cloudy season at Arequipa.

A southern station of the Astrophysical Observatory of the Smithsonian Institution has been located for a few years on a mountain near Calama, Chile. The climatic conditions there have proved to be exceptionally favorable for work on the sun. The new Harvard Observatory has been located at Chuquicamata, Chile, about twenty miles from the Smithsonian station, and at an altitude of between seven and eight thousand feet. The region is practically rainless, and the available records indicate long seasons of cloudless skies.

A ten-inch photographic telescope is being used for the study of variable stars in the southern Milky Way, and in the Magellanic Clouds. A special telescope with wide-angle lens carries on the photographic patrol of the whole southern sky, an investigation long maintained by Harvard in order to have a continuous record of the variations or of any unusual behavior of the brighter stars.

THE USES OF CHROMIUM

Science Service

CHROMIUM, a metal almost unknown 40 years ago, is now declared to be one of the indispensable elements in modern industry by Clifford B. Bellis in a report on the present uses of the metal to be published in the next issue of *Chemical and Metallurgical Engineering*. Stainless steel and high-speed steel are two of its many useful applications.

For chromium is a sociable sort of element. It is of little value alone, while as an alloy or companion of other metals it does indispensable work. Alloyed with iron it makes a steel that is both hard and tough, and so has made possible the development of many characteristically modern appliances.

It is estimated that without chromium high-speed steel tools, the works of the Ford company, at Detroit, would have to be seven times their present size, and it is certain that without the use of chrome steel in automobile engines, the motor car would be a very heavy and cumbersome contrivance. Airplanes such as we know them would be impossible.

Stainless steel is produced by alloying steel with about 15 per cent. of chromium; and rustproof iron contains about the same proportion although with a less amount of carbon.

Metallic chromium is now made in the electric furnace and has a number of useful applications. It has been found to have nearly the same coefficient of expansion as platinum and so is being used to some extent as a substitute for the more expensive metal in work requiring the sealing of metal with glass. Malleable chromium wire is being made by plating a copper wire with chromium, drawing down, replating, and continuing the process until the interior copper core is of negligible cross-section.

ROAD SURFACES

Science Service

AUTOMOBILE roads in New York are now being required to write a record of their roughness. An automatic autographic testing device which reveals the bumps in the road and records the amount of such irregularities has been adopted by the state, Colonel Frederick Stuart Greene, superintendent of the Department of Public Works, announced through the *Engineering News-Record*.

Harley Dunbar, one of the state's engineers, is the inventor of the instrument which is installed near the dash board of a car, where it is in plain view of the observer. Cars equipped with this device are simply driven over a pavement at twenty to thirty miles an hour. When either front wheel strikes a hole or a bump in the pavement the motion is transmitted to the pencils of the instrument causing them to draw on a small moving paper chart an irregular or straight line according to whether the road is rough or smooth. It is so arranged that the observer can make notes on the chart. The device constantly adds up the irregularities transmitted to the pencils, so that if the dial is read at the beginning of the road and at any time thereafter, the difference between the readings gives the amount of irregularities in the pavement.

According to Colonel Greene, before pavements are now accepted, they must pass the test with this instrument. From experience, he says, the department has found that the practical allowance for irregularities per mile for the various types of pavement, as shown by use of this machine on experimental roads, is for concrete, brick or asphalt block 50 inches per mile of pavement, for bituminous macadam mixing method 75 inches, and for bituminous macadam 125 inches.

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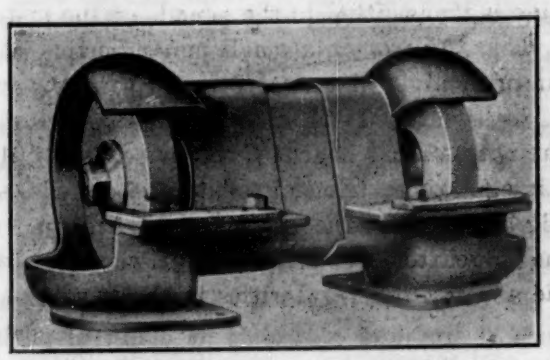

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RESUSCITATED FISH

Science Service

EXPERIMENTS conducted at the Atlantic Biological Station, St. Andrews, N. B., by Dr. S. W. Britton, on the degree of heat or cold a fish can withstand, show that it may be chilled to the extent that its heart stops beating and the whole body is stiff and numb, and then if the temperature be raised, it will soon recover.

The experiments were performed on flounder, eel, cod, skate, etc., which were living normally in a tank of water having a temperature of about 65 degrees Fahrenheit. From this they were transferred to cooling or warming tanks, the temperature of the water being gradually lowered or raised. In the cooling tank the water began to freeze at about 29 degrees. In this the fish could survive for a short time. Regardless of whether the cooling was slow or sudden, they would gradually stiffen. The heart was the last organ to succumb. They were kept in the water in this condition for from one to several hours, after which they could be resuscitated by raising the temperature.

The opposite extreme was 80 degrees Fahrenheit. With the gradual increase of temperature the fish showed restlessness and excitability. At 75 degrees respiration became difficult, but if the water was kept at this point a gradual adjustment took place and the fish got along quite comfortably after a while. When increased, however, respiration ceased and the heart stopped beating. The fish could be revived by lowering the temperature of the water or transferring them to a cooler tank.

DOMESTICATED OYSTERS

Science Service

THE domestication of the oyster has been accomplished and there is ground for hope that the threatened extinction of this important and delicious sea-food has been indefinitely postponed. The achievement is the work of the New York State Conservation Commission. Dr. Willian Firth Wells, biologist to the commission, has devised a method for the successful commercial application of well-known laboratory methods of oyster propagation and culture, and the new methods will be tried out on a large scale during the coming season.

Unlike fish, oysters have hitherto not been susceptible to artificial propagation. The minute size of the delicate, free-swimming oyster larvae has been the most serious obstacle, and a deplorable one, for oysters when "set" are a stationary and therefore an important commercial "crop." It is the decline of this crop which has caused millions of dollars loss to states through the decline in the value of the rentals of oyster beds, to the growers through loss of their crop, and to the public through higher prices.

In order to remedy this acute situation, the New York State Conservation Commission has been conducting an experimental shellfish hatchery at Bayville Bridge, Long Island. Ever since Professor W. C. Brooks, of the Johns Hopkins University, showed in 1879 how easily millions of eggs could be artificially fertilized and carried through the initial stages of development, it has been the dream of biologists to propagate oysters as other fish are propagated. Dr. Wells has now applied centrifugal principles to concentration of the larvae and the setting stage has been finally reached with possibility of important commercial applications.

Although the principal demand at present is to increase the yield of seed, undoubtedly the next step will be to improve the quality of oysters. The selection of breeding stock will inevitably lead to favorable varieties, as this has always followed the domestication of animals and plants. True domestication is not complete until such control is within the power of the culturist. Experiments along this line have been very encouraging, and it is not too much to expect that we shall some day select shellfish varieties as we do oranges or grapes.

CARBONATED DRINKS

Science Service

SOFT drinks, if carbonated, are safer than uncarbonated beverages. Researches conducted at the Mellon Institute, at Pittsburgh, indicate that carbon dioxide in solution is fatal to bacteria and that carbonated beverages which when bottled were not bacteria-free become almost sterile after storage of some weeks. The higher the bottling pressure and the greater the amount of carbonic acid gas in solution, the greater is the germicidal effect.

The investigation was carried on by J. R. Donald and A. R. M. MacLean, of J. T. Donald and Co., of Montreal; and by C. L. Jones, industrial fellow of the Mellon Institute, who states that the average bottled beverage, when not carbonated, is a fine medium for rapid bacterial growth. Such beverages may become highly dangerous if originally contaminated with germs which cause disease. Carbonation prevents this, they declare, basing their opinions on a large number of experiments.

These indicate that a beverage carbonated and bottled under sanitary conditions and with sufficient pressure, remains in a sanitary condition and actually improves in purity with storage. The experiments also show, in the opinions of the experimenters, that the fatal effects on the bacteria are proportional to the amounts of gas used and to the pressure employed. Higher bottling pressures are therefore advocated in the interest of health.

The experimenters take pains to state that carbonization is not to be considered a substitute for cleanliness or the use of water or materials of doubtful purity. In such cases the initial contamination may be so high that in spite of the germicidal effect of the dissolved gas, the drink will be dangerous, especially if consumed soon after bottling. The alternative of pasteurization after bottling is not recommended since it is apt to cause changes in the beverage which are hurtful to appearance and flavor. In conclusion, the experimenters declare that:

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PELLAGRA AND FOOD

Science Service

PELLAGRA may soon be an almost unknown disease. Surgeons Joseph Goldberger and W. F. Tanner, of the U. S. Public Health Service, in a report on the treatment and prevention of this disease, which while known all over the country has been especially prevalent in the south, state that fresh meat and fresh milk contain the essential preventive factors. A diet containing a quarter of a pound of lean beef, or a quart of milk a day will suffice as a preventive in all but very exceptional instances.

The milk may be taken either as sweet milk or as buttermilk, the preventive factors occurring in the protein of the milk. The butter fat, which is separated when the cream is removed, is without preventive power.

Eight victims of pellagra were treated by feeding them beef, and improvement followed in every case. The doctors emphasize that this is almost certainly not the only way in which immunity may be achieved, but they merely state that such a diet as has been described will prevent the disease. It even seems probable in their opinion that a much less amount of meat or milk will suffice, as an instance of which they cite the relative immunity of oriental races to pellagra in spite of a diet in which meat or milk forms a very small part. Other foods are apparently equally efficient preventives, but what these foods are is not as yet known.

But enough is now known, according to this report, to prevent the occurrence of the disease, to cure cases of at least moderate severity, and to establish that the primary cause of this serious and frequently fatal ailment is a faulty mixture of protein in the diet, or a deficiency in some dietary complex, possibly vitamin, rather than a germ infection or excessive consumption of starchy foods.

THE USE OF THYROID EXTRACT

Science Service

USE of thyroid extract as an anti-fat cure was condemned as dangerous by Dr. James H. Means, of the Massachusetts General Hospital, in a popular lecture at the Harvard Medical School on February 10.

"Thyroid reduces the weight all right, but how?" he said. "By intoxicating with an excess of the thyroid hormone. Stout people who take thyroid tablets to reduce their weight correct one evil, but a worse one is produced. Experiments show that when thyroid is used the pulse goes up, the individual gets nervous, perspires to excess and feels rather done up. Hard as it may be, the right way to treat obesity is through diet restriction and increased exercise."

Dr. Means told how the food consumed by a person is utilized as mechanical work or heat. The calories that a person uses can be determined by simply measuring the oxygen used by his lungs.

"The rate of combustion within the body of any given human or other warm-blooded animals measured under conditions of rest is remarkably constant if size be taken into account," Dr. Means said. "The performance of work and the taking of food markedly accelerate this metabolism, but if these factors are excluded, metabolism is found to proceed at a very even pace. We may compare the human or other warm-blooded animal to a lighted gas jet so arranged that it can not be completely shut off. We may open the cock wider and get a brighter flame, but we can not extinguish it.

"There is a fundamental minimal or basal rate of metabolism in the warm-blooded animal upon which the effects of other factors such as those of activity are superimposed. It is in the establishment and maintenance of this rate that the thyroid hormone plays its major rôle.

"In cold-blooded animals, the reptile, for example, there is no fundamental metabolic rate; the metabolism varies with the outside temperature. A snake has a fast metabolism and is highly active when warm, when cold its metabolism sinks to a very low rate and the animal goes into a lethargy. We find somewhat analogous phenomena in the human being when the supply of thyroid hormone is altered through disease, that is to say, an increased rate of metabolism when the gland is over active and a decrease when under active."

ITEMS

THE Governor-General of French West Africa has issued an order preventing the capture, detention and sale or exportation of living chimpanzees throughout the territory controlled by France, according to the Paris representative of the American Medical Association. Special permits to capture and export chimpanzees for scientific purposes may be secured by scientists and medical investigators. The permits are made out to individuals and are nontransferable. They are limited as to time, and the number of chimpanzees that may be captured is definitely stated. Furthermore, animals may be captured only with nets or traps, and not wounded. The new regulation is considered an important government recognition of the great necessity of animals for scientific experimentation.

PSYCHOLOGICAL laboratories for vocational guidance have been organized by the municipality of Berlin and are now giving advice to parents as to what occupations are most suitable for their children, the advice being based upon scientific study of the boys and girls. Many parents have sought the counsel of these laboratories which are using the most modern facilities of psychological research.

VESSELS at sea, especially those in extreme North Atlantic waters, may now obtain free medical advice by radio through the station at Thorshavn, Faroe Islands, about midway between Scotland and Iceland. The necessary advice will be furnished by the doctors at the hospital there. Messages may be in any Scandinavian language, or in English, German or French.

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As the number admitted to each class is limited, applications must be made before July 1.

Dean, Yale University School of Medicine

NEW HAVEN, CONN.

SCIENCE NEWS

A TELESCOPE FOR SOUTH AFRICA

Science Service

PROFESSOR WILLIAM J. HUSSEY, director of the University of Michigan observatory, at present in Africa, has found a location near Johannesburg for the new 27-inch telescope made possible largely through the gift of Robert P. Lamont, of Chicago.

The expedition to Africa marks the end of a 20-year search by Professor Hussey of the southern hemisphere to discover the best site for the telescope with which to carry on his work on double stars. Australia was visited in 1903 and South America in 1911. While on the latter trip Professor Hussey spent several years in Argentina, where he was director of La Plata Observatory.

Africa was the only continent left on which to find a site for the telescope. He has picked out one of the battle fields of the Boer war as a site for the new telescope.

In 1911 Mr. Lamont donated to the university sufficient funds to purchase a lens for the observatory. The order for the objective was placed with a firm in the east which has made the lenses for the Lick and Yerkes observatories. However, it was found that they could not secure suitable glass for the work, so a European firm was given the order.

With the world war coming on, this firm refused to take the risk of shipping the huge glass to this country and the contract was let to an American firm. But in 1921 the order was again cancelled and given to a European dealer, who was able to obtain the needed materials. The discs arrived in America a year ago and the work of polishing them began.

It is hoped that the new telescope will be ready by next fall. The lens probably will be ready by that time, and only the lower end of the tube and the other sections remain to be finished. This can be completed in a very short time.

Work on the lens was threatened for a time last fall when J. B. McDowell, who was putting the finishing touches to it at his factory in Pittsburgh, committed suicide. It is thought that the extreme nervous strain of the work proved too severe for McDowell, as he had reached the point where he alternately polished for three minutes and waited 60 minutes for the temperature of the glass raised by the friction of polishing to go down to normal. An associate of McDowell has taken charge of completing the work.

Professor Hussey is considered a leader in the field of astronomy which deals with double stars. So far about 1,500 of these stars have been discovered, but the heavens have not yet been covered, and it is expected that many new ones will be found by the aid of the new telescope.

A LABORATORY FOR COLLOID CHEMISTRY

Science Service

THE prevention of tuberculosis, the development of hardy winter wheats and the prevention of settling of concrete roads on clay soil may all be aided by investigations at a National Research Laboratory for Colloid Chemistry, the preliminary idea of which was announced here to-day by Professor J. Howard Mathews, head of the department of chemistry of the University of Wisconsin.

Dr. Mathews explained that the proposal of such an institute has been given great impetus by the support recently accorded it through the unanimous approval of the project by the colloid committee of the National Research Council, under the chairmanship of Dr. Harry N. Holmes, professor of chemistry, Oberlin College, Oberlin, Ohio.

Any solid so finely subdivided that it does not settle out of solution readily or behave as ordinary solid particles do is regarded as existing in the colloidal state. Many forms of living tissue are suspensions or solutions of this sort. Gelatin, glue and other gummy substances are also in a colloidal condition. The constituents of the hides which permit them to be tanned into leather are colloids.

If it were not for the colloids in clay that make it plastic, it would be impossible to mold many forms of pottery, brick and other clay products. It is this very plasticity of clay which makes it such a poor foundation on which to build the modern concrete roads.

AN AIRPLANE CAMERA

Science Service

THE surveyor by taking to the air will be able to make more accurate contour maps with greater speed than now possible, Professor H. L. Cooke, of Princeton University, indicated in a recent address before the Franklin Institute when he announced the development of a new method of taking and interpreting airplane photographs for map making.

Wide-angle lenses that photograph ten square miles of territory from 10,000 feet in the air, a new method of making time exposures from speeding airplanes, a new optical method of locating the airplane in space, and stereoscopic projections of the photographs contribute to Professor Cooke's improved method of surveying.

"A rapid and accurate method of producing contoured maps from airplane photographs is urgently required in practically all the civilized countries of the world," Professor Cooke explained. "In this country there are still about two million square miles which have not been covered by contour maps, and the need of maps is felt daily by large industrial interests. At the present rate of progress it will require more than forty years to complete this work, but now that the problem of airplane surveying has been solved it is certain that within a quarter of a century this country will be completely mapped.

"Photographs made from airplanes by present methods are not sufficiently accurate for use in the making of government maps. In the near future it will be possible to run aerial traverses between geodetic control points

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Requirements for Admission.—Three years of pre-medical college work.

Classes Limited.—The number of students admitted to each class is limited, selection of those to be admitted is made on the basis of merit in scholarship and other qualifications requisite for the study and practice of medicine.

Hospital Year.—The fifth year, consisting of service as an interne under supervision of the faculty in an approved hospital, or of advanced work in one of the departments is prerequisite for graduation.

Summer Quarter.—The college year is divided into four quarters, three of which constitute an annual session. The summer quarter in the climate of Chicago is advantageous for work. Students are admitted to begin the medical courses only in the Autumn and Spring quarters.

Elective System.—A considerable freedom of choice of courses and instructors is open to the student.

Graduate Courses.—Advanced and research courses are offered in all departments. Students by attending summer quarters and prolonging their residence at the University of Chicago in advanced work may secure the degree of A.M., S.M., or Ph.D., from the University.

Prize Scholarship.—Six prize scholarships—three in the first two years and three in the last two (clinical) years—are awarded to college graduates for theses embodying original research.

The Winter quarter commences January, 1924.

Tuition—$80.00 per quarter, no laboratory fees.

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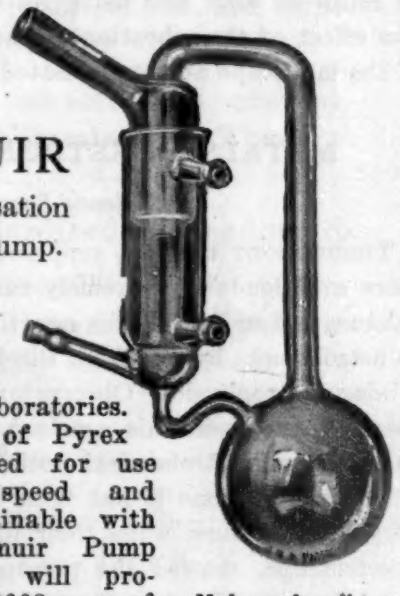

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at intervals of twenty to thirty miles and thereby eliminate the enormous cost of secondary and tertiary triangulation.''

Some ground surveying will still be necessary with the new method, and detailed information not given by the photographs will be obtained by surveyors travelling around in small cars with enlarged prints of airplane photographs on which missing information will be sketched to be forwarded to the drafting room.

The accurate determination of the position of the airplane in space is effected by the projection of the photograph upon a glass screen upon which three known points of the landscape pictured are placed in correct relative position. If the relative position of the photographic plate and the projection lens is the same as when the picture was taken and if the fixed points on the screen and in the picture be made to coincide, the distances from the lens to the fixed points on the glass screen bear exact relations to the distances of the fixed points in the landscape which was photographed, and what is most important, to the height of the airplane above the ground when the picture was taken.

With the height of the airplane known, cross-bearings may be taken of all points of the landscape, and by means of stereoscopic projection, the landscape may be shown in relief, and contour lines quickly mapped.

Professor Cooke attached great importance to the production of a camera capable of taking wide-angle pictures of relatively long exposures while moving at high speed. He has been at work for several years on the production of such an instrument, and said it was now possible to take photographs showing sharp definition while travelling 90 miles an hour and using an exposure of one second. The effect of the vibration of the airplane and the drift of the landscape are compensated for by suitable devices.

METALS IN ASTRONOMIC SPACE

Science Service

THROUGHOUT the vast supposed ''emptiness'' of space there are clouds of extremely rare vapors of the metals, calcium and sodium. This new theory has been presented to astronomers by Dr. J. S. Plaskett, director of the Dominion Astrophysical Observatory, Victoria, B. C., who recently announced his conclusions and offered his data to the Royal Astronomical Society in London.

For a long time it has been known that some of the very hottest stars, when their light was analyzed in the spectroscope, showed the presence of calcium, that did not belong to the stars themselves. For the spectroscope revealed the fact that while the stars often had considerable velocities, the calcium seemed to be almost at rest. Moreover, this calcium persisted in appearing in just those stars where theories of stellar composition indicate it should not.

In explanation, some astronomers suggested that the stars are surrounded by an envelope of calcium gas belonging to the stars themselves. Others proposed that the calcium clouds were lying between us and the stars. The observations, however, were so meager and contradictory that no definite conclusions could be arrived at.

Dr. Plaskett's observations indicate that although extremely rare clouds of calcium and sodium vapor are lying around in space everywhere, they are only noticed in the neighborhood of stars. This is because, surrounding these stars completely, they intercept some of their light. The clouds appear to be perfectly at rest in space, acting as a sort of misty envelope of the stars, a space-fog, which possibly can condense in spots and give rise to those peculiar dark nebulae which have long puzzled astronomers.

WATER POWER AND COAL

R. S. McBride, Science Service

THE power being developed by the government at Muscle Shoals promises to be among the cheapest of great water power developments in the United States. There is no wonder, therefore, that the government is receiving several important offers for the privilege of leasing this power development. Several power companies of the southeastern states have associated themselves together for one offer; Mr. Ford nearly two years ago made another offer; and lately a third proposal has come from electrochemical interests who desire to operate the property for the government. Many political as well as economic factors affect the consideration of these proposals. But the engineering facts which determine the probable cost of Muscle Shoals power are not subject to dispute.

The power generated from a waterfall costs more or less according to the investment required for dam, power house and electric equipment. The cost of operation of any such hydro-electric power station is small, so that the cost to the user of current is almost altogether dependent upon the cost of building the plant, for example, whether it requires $150, $200 or $250 per kilowatt of installed power capacity. At Muscle Shoals the power promises to be very cheap because the investment cost there is relatively low and the quantity of power which will be developed is very great, amounting at the maximum capacity of the power station now under construction to 250,000 horsepower.

It is very important to compare such big water power plants with installations of similar capacity which might generate power from steam made by burning coal. The initial investment required for such steam electric station would be relatively much less, but the cost of operating would be several times greater than in the hydro-electric station, just how much greater being determined principally by the cost of coal.

If coal costs $4 per ton at the steam power station, and a hydro-electric plant could be built for $150 per kilowatt of capacity, about $112 per horsepower, then there would be little choice between the two. In other words, with low investment for hydro-electric station and low fuel cost for steam-electric, it makes little difference to the power user which way his current is generated. But let the cost of labor and of concrete for building the dam increase by 33 per cent. so that the installation would cost $200 per kilowatt of capacity installed and then the steam-electric station could afford to pay $6 for its coal supply or perhaps even more than that.

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(See: Gerstenberger: Amer. Jr. Diseases of Children, Oct., 1923.)

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(cf.—Osborne & Harris, Jr. Am. Chem. Soc., 25-IV. 346)

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In any case the cost of recovering the energy from the waterfalls to light our cities and to run the motors of industry may be greater than the cost of making this electric current by burning coal under a boiler. Every new installation requires careful study of local conditions to determine the relative costs. But in the case of Muscle Shoals water power plant there is no doubt that whoever leases the property will be securing power about as cheap as it is possible to make it anywhere on the American continent.

THE AUDIBILITY OF CONSONANTS

Science Service

A SYLLABLE ending in "ng" is the most difficult speech-sound for the ordinary ear to grasp, according to data recently secured by Dr. V. O. Knudsen, physicist in the University of California, Southern Branch. "S," "W" and "Y," on the other hand, are easy to grasp and score high in a hearing test.

A large audience was tested in an acoustically poor auditorium. An announcer called out at intervals a succession of meaningless syllables while several hundred auditors recorded what they thought they heard. Only 48 per cent. of the audience caught such expressions as "ting" and "bong," but 90 to 100 per cent. were right on sounds like "wis" or "yox." The sounds "d," "b" and "th" made a poor score. Changes made in the choice of auditorium and announcing personnel did not alter the results markedly.

These experiments are part of a research program to reduce the present vague principles of acoustics to a mathematical basis. Results so far obtained show that an audience must attain on the average at least 65 per cent. accuracy on all speech-sounds, in every part of an auditorium, if the acoustics are to be judged satisfactory. Telephone engineers, using these methods, require 75 per cent. accuracy before a talking circuit is pronounced adequate. The telephone listener is at a disadvantage because he can not see the speaker's lips, and thus must be able to hear a larger part of incoming syllables before he can safely guess the rest.

Following somewhat similar lines, the Southern California Telephone Company has recently abandoned many word-prefixes of Los Angeles telephone numbers, and has adopted a new series promising higher accuracy. Such words as "Capitol," "Drexel" and "Metropolitan" are accurately heard by operators, and at the same time carry the proper lettering to suit new switching machinery.

DEATHS IN 1923

Science Service

THE year 1923 was one of the best years from the standpoint of public health ever recorded in the United States and Canada. This conclusion is based on the record for the year among the 15 million industrial policyholders of the Metropolitan Life Insurance Company, which was made public to-night by Dr. Louis I. Dublin, statistician. A slight increase in the death rate over 1922 is due wholly to an increase among the two million negro policyholders. The rate for the whole group of individuals was 8.9 per 1,000 as compared with 8.8 in 1922. The rate in 1911 was 12.5.

Several new health records were established last year. The death rate for the third quarter was the lowest ever recorded for any three months among this group of risks, while the rates for the last six and the last three months of the year were the lowest ever recorded for those respective periods.

Practically all the more important group of infectious diseases showed decreases for the year. This was particularly true of tuberculosis, which showed a decline of 3.2 per cent. from 1922. Ten years ago the rate was nearly double what it is to-day and in 1911 more than twice as many people proportionately of this selected group of persons died of this disease than died last year. The death rate for typhoid fever has declined further, and shows a total decline of 77 per cent. since 1911.

Organic heart disease was the leading cause of death for the year and showed in increased rate over the previous year. Deaths from accidents, and homicides also, increased while those from cancer, Bright's disease, and cerebral hemorrhage were approximately the same as for 1922.

The increase in deaths from automobile accidents and from homicides are called "disquieting." The homicide rate is now 7.3 per 100,000 or more than 12 times that of England. Much of this is said to be due to the homicidal propensities of negroes.

Automobile accidents are now a major cause of death, showing a rate of 15 per 100,000 for the year. This is an increase of 50 per cent. as compared with five years ago and of 300 per cent. over the figures for 1913. The total automobile fatalities for the year throughout the United States are estimated at close to 15,000.

ITEMS

Science Service

EXPOSURE to cold has been found to slow up the heart but to make it beat stronger, says J. Barcroft, of the physiological laboratory of Cambridge University, in a report to the Department of Scientific and Industrial Research. The pulse rate is lowered by cold, but the volume of blood passing through the heart in any given time is increased. This is stated in the report to be the first time the pulse rate and the volume output of the heart have been observed to vary in opposite directions.

IF their menu card contains both codliver oil and eggs, babies will select eggs. For this reason Dr. Alfred F. Hess, of New York City, believes that the yolk of eggs will be a welcome therapeutic agent in the treatment of infantile rickets. Egg yolk has been found to be a preventive and cure of rickets similarly to codliver oil, although it is not as potent, and he recommends it as a supplement to the dietary, comparable to orange juice used to protect against infantile scurvy. The yolk of a raw egg added to the sweetened milk and water of infants' food brought up their weight and improved their health. Egg yolk contains a vitamin that cures rickets, but it may not be vitamin A.

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SCIENCE NEWS

BIOLOGICAL STATION OF THE INSTITUTION FOR RESEARCH IN TROPICAL AMERICA

Science Service

CONSTRUCTION of a biological station on the wild, virgin jungle of Barro Colorado Island, in Gatun Lake just off the steamship channel of the Panama Canal, has been begun by the Institution for Research in Tropical America, in which over twenty of the leading museums, societies and universities of the United States are cooperating, according to the report of Dr. A. S. Hitchcock, chairman of the executive committee of the organization, announced at the Smithsonian Institution.

The island was created by the formation of Gatun Lake in the building of the Panama Canal. It was one of the high spots in the tropical jungle which was submerged to make the lake, and contains over 3,000 acres. As the waters arose in the lake, the forest animals took refuge on it in unusual numbers. Many jaguars, tapirs and other large animals are known to exist on Barro Colorado, which is also an insect paradise and rich in plant material.

Last June the government set the island aside as a reservation for biological research. No hunting, tree cutting or settlement is allowed on it. It has been given to the custody of the Institution for Research in Tropical America and a laboratory is being erected where biologists, entomologists, zoologists and botanists may find shelter for their apparatus and a place to set up their cots. James Zetek, of the U. S. Department of Agriculture, is serving as the local custodian of the station.

Barro Colorado is only a mile and a half from Frijoles Station, on the Panama Railway, ten miles from Gatun and ten miles from Gamboa. But, although easy of access, the scientists working at the laboratory will literally have the wild at their door. Within a few feet of the station now under construction there is abundance of unstudied plants, animals and insects. The building will be screened and protected against the wood-eating ants which abound in the tropics.

Not only has this government recognized the importance of Panama as a field for biological study, Dr. Hitchcock said, but the Republic of Panama also recently set aside a beautiful site for a Marine Biological Station on the bay front in the modern section of the City of Panama, next to the site of the Gorgas Memorial.

The Institution for Research in Tropical America operating the Barro Colorado site was initiated by the National Research Council and is an association including representatives of the American Anthropological Association, American Museum of Natural History, American Phytopathological Society, American Society of Agronomy, Brooklyn Botanical Garden, California Academy of Sciences, Carnegie Museum, Commercial Museum of Philadelphia, Ecological Society of America, Harvard University, Indiana University, Johns Hopkins University, National Geographic Society, New York Academy of Sciences, New York Zoological Society, University of Michigan, Philadelphia Academy of Sciences, Smithsonian Institution, Yale University, University of Florida, American Genetic Association and the National Research Council.

RADIO

Science Service

A NEW, directive type of radio beacon which will be of great use to navigators of the air or water has been perfected by the U. S. Bureau of Standards in cooperation with the Signal Corps and Air Service of the Army. It will make direction finders on shipboard less necessary.

The beacon consists of two coil antennae so placed as to cross each other at an angle of 135 degrees. The transmitting set is automatically connected first to one and then to the other, one letter of the signal being sent over each. The intensity of the signal from an antenna of this type varies from a maximum in the plane of the coil to almost zero at right angles. A receiving set placed along the line bisecting the angle between the coils will therefore receive signals of equal intensity from both.

A ship or airplane receiving the signals will be able, by first proceeding to the point where the two signals are of equal intensity, to steer directly for or away from the beacon without regard to conditions of visibility. The signals may be received by the most ordinary receiving set and may thus be of value to motor boats and small craft generally.

The invention will be of great value in aviation. Its efficiency was recently proved when an airplane flew from Dayton to a point 100 miles away, with the pilot depending for guidance entirely upon signals received from one of these beacons by means of an ordinary airplane receiving set.

It will also be used in the navigation of rivers and crooked channels to supplement the range lights now employed. Beacons can be placed at the range light locations and navigators will be able to follow a straight course on the foggiest nights. It has already been tested successfully along the Potomac River and Chesapeake Bay by the Lighthouse Service, and may be used on the Mississippi River. Lighthouse stations along the coasts may be equipped with the new device, but it can not be used on lightships since they are continually shifting their directions with wind and tide.

Rules for the regulation of radio throughout the Western Hemisphere will be considered and formulated at the coming Inter-American Electrical Communications Conference which is scheduled to meet in Mexico City, March 27. The United States will be represented by two official delegates to be selected by the State Department, who will be accompanied by a number of technical advisers. All Latin-American countries, and Canada, are expected to send delegates.

The conference was proposed at the meeting of the Pan American Congress at Santiago, Chile, last year; and

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the place of meeting was decided at a meeting of Latin-American representatives at the Pan American Union in Washington. All forms of electrical communications will be discussed but radio will be the principal topic, the general purpose of the conference being to bring up to date the regulations adopted at the London radio conference in 1912 and to amend them to fit conditions in the Western Hemisphere.

An international conference for the drawing up of radio regulations for the entire world has been proposed to the Advisory Committee on Communications and Transit of the League of Nations with the request that the council of the league take the necessary preliminary steps. The proposal was made by a committee of radio experts which recently met in Geneva. No official recognition of the proposal has yet been made by the United States.

PIONEER INVENTIONS OF THE CHINESE

Science Service

CHINA produced fundamental discoveries and inventions of greatest value to the human race long before the rise of western civilization, according to a statement made by Chung-Yu Wang, consulting mining engineer of Hankow, China, to the Engineering Foundation of New York. Mr. Wang points out, however, that "Unfortunately for China, and indirectly for the world, the Chinese mind, through centuries of classical education, has failed to make application of its new ideas and to make any progress from the inventions and discoveries of the ancients." The Chinese invented the compass, paper, printing, glass, the seismograph and many alloys, and, in addition, anticipated modern medicine.

Records show that Chow Kung in the Chow Dynasty, about 1122 B. C., used a kind of wagon equipped with an instrument that pointed always toward the north. Paper was first made by Tsai Lun, out of tree fibers, rags and hemp, during the Dynasty of Eastern Han, the early part of the first century. Fung To originated the art of stereotyped wooden plates about the year 932 A. D., but later investigation made by the sinologue Stanislas Julien has shown that the invention actually dated from the year 593. Glass was first manufactured by Pun Fang about the early part of the second century, and he had a piece carved with 130 designs. An instrument, resembling perhaps the present day seismograph, was invented by Chang Heng in the first century, during the Han dynasty, which could record any slight earthquake not perceptible by human senses.

In Tai Hao's time (2852–2737 B. C.) metallic coin was already in circulation. The inventive genius of the ancient Chinese can nowhere be more explicitly shown than in the art of making alloys. An alloy, similar to German silver, under the name of Pait' ong, was obtained by fusing "red steel" with arsenic. The manufacture by the ancient Chinese of gongs and tom toms, with their perfect tones, still remains to us a mystery, although their chemical composition has been determined. Mr. Wang also believes that there is a great deal of Chinese medicine that is both useful and illuminating when viewed in the light of occidental medical science. The Chinese anesthetic, known as Ma Fat powder, a sort of hashish, was discovered by the famous Chinese surgeon, Hwa To who lived in the early part of the second century during the Eastern Han dynasty. An old Chinese text tells us that Hwa To administered the medicine to his patients to render them unconscious before being operated upon. This happened long before ether or chloroform was discovered in Europe.

Recently two experimenters at the Rockefeller Institute for Medical Research, in New York City, obtained a white secretion, which they have named Bufin, by stimulating the parotid gland of the toad by means of electricity. Its physiological action is almost similar to that of digitalis. This is merely a rediscovery of a medicine long known in China. The identical white secretion is obtained by the Chinese by touching the biggest wart-like swelling just behind the eye of a toad with a hot iron. The secretions thus obtained from many toads are allowed to evaporate slowly to a powder, which is now mainly used as a heart remedy.

ARTIFICIAL MANURE

Science Service

ARTIFICIAL "farmyard" manure made without the use of animals is the achievement of English scientists at the Rothamsted Experimental Station. Chemical methods have been worked out whereby various plant products can be converted into a manure quite comparable with farmyard manure, and the process is being applied with success on a commercial scale in various parts of the world. The new fertilizer is expected to aid the tractor in its conquest of the farm.

Plodding scientific research led up to the invention. From 1913 to 1915, E. Hannaford Richards, a sewage chemist, investigated the losses which take place in the preparation and storage of farmyard manure. They were found to be very great. Mr. Richards considered the avoidance of part of these losses, which his work showed to be possible, as merely making the best of a bad job. To use his own words: "From the very start I set myself the problem of devising a method for preparing from plant products, such as straw, a substitute for farmyard manure which should be more economical than making the real farmyard manure by the recognized method."

His training as a sewage chemist enabled him to recognize the great similarity between the changes which take place in the manure heap, on the one hand, and in sewage purification on the other. Pooling information with a scientist who had been working independently on the utilization of organic materials in the soil, the invention was made.

In the manure heap there is always loss of nitrogen, chiefly as ammonia, but also in other forms, before it is put on the land; if straw itself be used as a manure it has a depressing effect on the yield. The highness of the ratio of nitrogen to carbonaceous matter is tied up with the loss of nitrogen in the first case, and the lowness of this ratio is the cause of the decreased yield in the second case. The essence of the new artificial method is to ad-

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just this ratio so that there is neither loss of nitrogen in the rotting, nor excess of decomposable carbonaceous matter in the finished product.

This ratio varies for different waste products; as a result it is necessary to do an assay on any new material before it can be decided first whether it be suitable for the process, and, if so, secondly, what chemical activator shall be added to cause the material to rot satisfactorily. Even when the process was shown to have economic possibilities there were still great difficulties in placing it on a large scale. Viscount Elveden, who had always been interested in agricultural research, and whose ambition it had been "to see whether it is not possible to make certain branches of scientific research self-supporting," provided the capital necessary for commercial development.

Commercial tests to date show that straw, bark, banana leaves, bracken, rubber residues, rushes and Nile sud can be made into useful manure. Certain of these have been converted into manure on a large scale at a satisfactory cost.

COLOR GRADES FOR HONEY

Science Service

THE most extensive study of colors of honeys ever undertaken has just been completed at the Bee Culture Laboratory of the U. S. Department of Agriculture, says Dr. E. F. Phillips, in charge of the work. This investigation is expected to result in the standardization of the grading of honey according to color and to eliminate much confusion in the honey trade.

Commercial graders now on the market differ widely in the number of grades and the color shades used to indicate the differences. In the work just finished, the scientists secured the most complete collection of American honeys ever made, including samples from every state in the Union and several foreign countries representing 450 gradations from clearest water-white to the darkest amber. From this collection they have worked out eight standard color shades with which any given sample of honey can be compared to determine its proper grade.

As honeys change in color with time, the honeys themselves could not be used in a series of bottles which will serve as containers for the grade colors. It was necessary to devise chemical materials corresponding in color and opacity with the fresh honeys.

To do this, light transmitted through the various honey samples was measured by the spectro-photometer. This instrument breaks up the transmitted light into its various color waves by means of a prism. Substances were then prepared synthetically which would have fast colors which would transmit light with wave lengths corresponding to the wave lengths transmitted by the different grades of honey.

The government will place its findings at the disposal of all the manufacturers with directions telling how to make the standard graders. In the collections of honey made for this study, the lighter grades came mostly from the north and the darker grades from southern and tropical regions. This is believed to be due to the fact that the southern bees gather their raw material mostly from trees and the northern bees from smaller plants.

TAGGED SALMON

Science Service

FISH No. 10,358, one of the 10,000 salmon caught, tagged, and released by the United States Bureau of Fisheries south of Alaska last season, has turned up in a Siberian stream 2,000 miles across the ocean. He made the trip to get to his wedding at the old home stream where he began life as an egg.

This remarkable tale of Fish No. 10,358 is not a mere fisherman's yarn but is backed up by scientific records on two continents. According to the files of the Bureau of Fisheries, No. 10,358 belonged to the Oncorhynchus keta or dog salmon family. The identification tag stamped with this number was clamped on his tail last Fourth of July off the north shore of Unga Island, Alaska.

Released to go his own way, No. 10,358 evidently lost little time heading for home. According to word recently received from the Far Eastern Bureau of Fisheries, the fish wearing the tag marked "U. S. B. F. No. 10,358" was caught on August 18 in the river Pankara in the district of Karagin on the eastern shores of the peninsula of Kamchatka. The local residents did not pay any attention to this mark and the fish was cleaned and salted. Agents of the Far Eastern Fisheries Board at Vladivostok discovered No. 10,358 in the preserved state.

Examination showed that the fish was a male and had grown teeth. As salmon return to spawn in the same stream in which they were hatched from the egg, it was plain that No. 10,358 was a native of Kamchatka. Other tagged fish of the dog-salmon family have been retaken in Alaskan streams to the east of the feeding ground where they were tagged.

ITEMS

Science Service

MANY new species of orchids and ferns are included in the 4,500 botanical specimens just brought back from Central America by Dr. William R. Maxon, of the Smithsonian Institution. The rain-forests on the slopes of volcanoes in the interior mountain region of Costa Rica have a remarkably rich flora which will furnish an almost inexhaustible supply of plant material for scientific study for years to come.

THE red man's fondness for gaudy color schemes has long been known, but it has remained for Dr. T. R. Garth, of the University of Denver, to ascertain scientifically the color preferences of the Indians in the southwest. Full-blood Indians were found to prefer red to all other colors, then blue, violet, yellow and white in the listed order. White men, living in the same social and educational environment, preferred blue, then green and then red. The education of the red man has little apparent influence upon his favorite colors. The squaws and the braves agreed more closely in their select colors than the whites and the Indians did. The full-blood Indians were found to be very emphatic in their color preferences, much more so than the mixed bloods and the whites.

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NEW HAVEN, CONN.

SCIENCE NEWS

THE FIXATION OF NITROGEN

Science Service

AMERICA now has the most effective method of fixing nitrogen of the air in such a way that it can be used as plant food in fertilizers or in making explosives.

Through scientific work at the Fixed Nitrogen Research Laboratory of the U. S. Department of Agriculture in Washington, a catalytic substance has been developed that brings about the fastest known reactions between hydrogen gas and nitrogen gas to form ammonia.

No formal announcement has yet been made as to the composition of the new catalyst, but Dr. Alfred T. Larson, under whose direction the research work has been carried on, stated to a representative of Science Service that it is made of iron oxide, aluminum oxide and potassium oxide. Since it is composed largely of iron its cost is very low. Methods for large-scale commercial production have been perfected.

The new catalyst is declared to give yields at least twice as high as the best catalysts now known. Through the use of low temperatures and very high pressures, high percentages of the gases are made to combine by this new catalyst. At a pressure of 1,000 atmospheres, 60 per cent. conversion has been obtained. The United States nitrate plant No. 1, at Sheffield, Alabama, was designed for a process that can use this new iron catalyst of superior activity.

Shortly before the beginning of the world war, German chemists perfected the Haber process for the fixation of atmospheric nitrogen, which supplied Germany with nitrates when the usual supplies from the great nitrate beds of Chile were cut off by the blockade. The chemical composition of the catalyst used in the German plants has been jealously guarded as a trade and military secret. Even now American chemists do not know what substances are used in German plants to make the molecules of hydrogen and nitrogen gases get together and make ammonia.

The development of the catalyst used here has been an entirely independent achievement, and according to Dr. F. G. Cottrell, former director of the U. S. Bureau of Mines and now director of the Fixed Nitrogen Laboratory, "As far as we have been able to learn, there is no country in the world which has an ammonia catalyst superior to that developed by this laboratory."

Contrary to policy in every other country, no secret is being made of the results of the research work of government fixed nitrogen chemists. Full details are being given to all who are interested.

Large forces of chemists are understood to be at work in Germany, France and Japan on similar problems and in all cases results are being withheld as trade or military secrets. In Germany, in spite of poor economic conditions, twice as many chemists are at work on this one problem as in the United States. England has a force of 40 to 45 scientists studying atmospheric nitrogen fixation, approximately the same number as is at work here, and Japan spends as much on nitrogen researches as this government does.

Although over 36 per cent. of the nitrogen produced in the world is now supplied by fixation of atmospheric nitrogen, less than one per cent. of America's present requirements are supplied by atmospheric nitrogen fixed within this country. Only one commercial plant, located at Syracuse, N. Y., is operating that uses the synthetic ammonia process, and the catalyst used there is being kept a secret.

The government plant at Muscle Shoals, now idle, has a capacity only one fifth of the 200,000 tons consumed in the United States at the present time. This large plant employs the cyanamide process, which if operated would not utilize catalysts perfected for the synthetic ammonia process.

With no large nitrogen fixation industry in this country, and with 3,000,000 to 4,000,000 tons of nitrogen, equivalent to 150,000,000 to 200,000,000 tons of commercial mixed fertilizers, being lost from land under cultivation and not replaced, the need of intensive nitrogen research to assure adequate nitrogen supplies in the future is declared to be imperative.

PLANT VEINS

Science Service

THE vascular bundles of plants have been found to serve a purpose similar to the nerves of animals, Professor Henry H. Dixon, F. R. S., told an audience at a lecture in Dublin, Ireland. These vascular bundles not only carry raw food material from the roots to the leaves, but also transport the "chemical messengers" which take the place of nerve impulses.

The similarity of distribution of the vascular bundles in plants and that of the nerves in animals was noticed long ago, but as the details of the two systems were worked out differences between the two became accentuated rather than the similarities; now the latter are receiving more attention. In both cases a stimulus given to one part of the body often causes a reaction in a different part. If the tap-root of a plant be artificially deflected from the vertical, a stimulus is set up in a cell just behind the root tip, which results in a bending of the root at that point till it is again growing vertically downwards. Again, when the tip of a grass-seedling is illuminated on one side a stimulus is transmitted thence downwards to the shaded part and causes curvature there.

It has been shown that the stimulus is propagated through some plants at a rate of 10 to 20 millimeters per second. This speed, though slow compared with the velocity of transmission of stimuli along animal nerves, is fast for plants. Scientists are beginning to believe that the stimulus is conveyed by chemical messengers or "hormones" liberated by the stimulated part into the transpiration stream.

In Professor Dixon's words: "Whatever the intimate

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mechanism of the system is, the subject of the transmission of stimuli through plant tissues offers a striking example of the swing of the scientific pendulum of scientific opinion. The view based upon superficial resemblances, that the vascular bundles are the nerves of plants, was long abandoned, but now we see there is clear evidence that they actually transmit stimuli from the sensory to the motor regions, and so perform the functions of nerves''; but there are very great differences in detail between the modes of action in the two cases.

THE FOOT AND MOUTH DISEASE

Science Service

THE dread foot-and-mouth disease of cattle has broken out in California. Vigorous action has been taken by the Secretary of Agriculture to prevent its spread to other parts of the country. Trained workers of the Bureau of Animal Industry, experienced in previous epidemics, have been rushed to the scene of the outbreak and a tight quarantine has been clamped on the infected area.

Every effort will be made to prevent a repetition of the spread of the disease in 1914, when in thirty days' time twenty-two states and the District of Columbia became affected. That outbreak was not stamped out until 1916, but this country has been free from the contagion since that time. In Great Britain and most European countries it has gained such a foothold that it is thought that the infection is permanent. In some cases 30 to 40 per cent. of the young cattle die from the infection, although in this country it has not been so fatal, showing a rate of only two or three per cent.

Foot-and-mouth disease is, however, extremely contagious and other animals besides cattle may be affected. Human beings are mildly susceptible to the disease, which may be carried on clothing, farm implements, or other objects which come in contact with the virus from the infected animals.

The germ that causes the disease has never been isolated, but is believed to be one of those which are so small that they pass through the pores of a porcelain filter. The disease usually appears on the back part of the tongue of the animal and between the toes on the feet in the form of small rounded elevations of the skin, from the size of a pin-head to that of a nickel, and containing an amber liquid. When these vesicles break, the liquid carrying the disease germs runs out. The udders of cows also become infected and the infection is sometimes carried into the milk. The virus-containing milk is thought to be the source of the infection of man by the disease.

The quarantine declared by the Secretary of Agriculture covers Alameda, Contra Costa and Solano counties in California, where the disease has made its appearance, prohibits the shipment of cloven-footed animals from the areas, provides for the disinfecting of cattle cars and hay in the quarantined district and requires the sealing of cattle shipments passing through.

How the present infection gained entrance to this country is unknown, but it was first discovered in a large dairy herd near Oakland.

THE TESTING OF BRAKES FOR AUTOMOBILES

Science Service

A NEW, portable device for testing the effectiveness of automobile brakes has been perfected by the U. S. Bureau of Standards. The invention is largely the work of W. S. James, chief of the automotive power section, who had the work in charge. It does away with the need for measured stretches of road, eliminates all the personal factor of the driver, and gives instantaneous results.

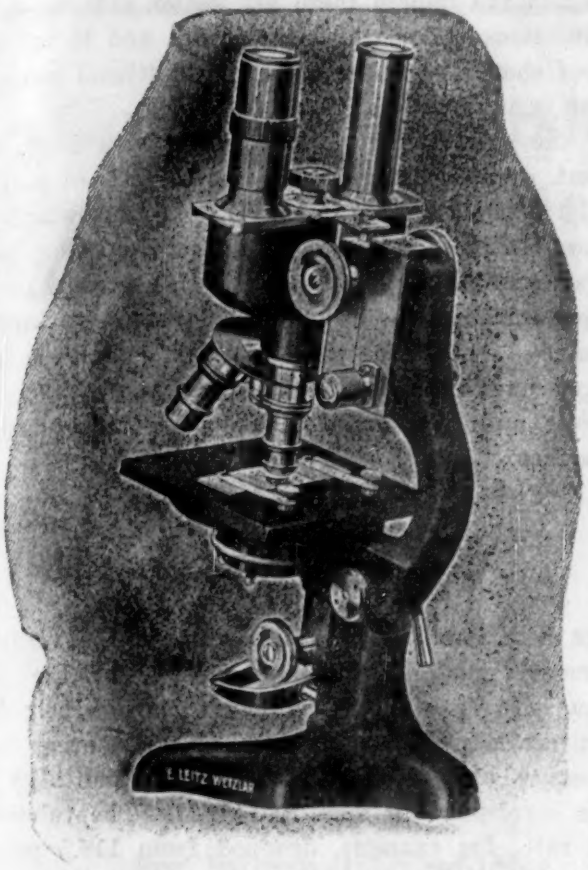
The essential principle of the invention is a suspended weight, which, when the brakes are applied and the car slowed down, swings forward, an effect which every one who has ridden in a moving vehicle has noticed when the brakes were strongly applied. In the testing device, the swinging weight is immersed in oil so as to slow down its swing and prevent vibration, and it is connected with a recording pen or pointer which measures the extent of the swing. This in turn measures the retarding power of the brakes.

No calculations are necessary to get the results, at least none by the inspector. With the weight of the swinging weight or pendulum known, the pointer may be made to show just the number of feet in which the car may be stopped when traveling at any given speed, such as 20 miles an hour. If this is known, the distance taken to stop at other speeds may be calculated. The efficiency of the device does not depend on the weight of the car, and since it is only about a foot long and less than that in other dimensions it may be carried about and used in any car.

Results obtained so far indicate a close agreement with observed measurements of the actual distance required to stop cars. In order to eliminate all personal factors, a revolver firing a small charge of red lead was connected with the brake pedal in such a way that when the brake was applied the revolver would be discharged toward the road. The distance from the spot of red to a point directly under the revolver when the car was stopped was then measured.

From these results it also seems that present standards for two-wheel brake effectiveness for the average car are set at impossibly high levels, although they are within the reach of four-wheel brakes, and some two-wheel brakes in first class condition. Balloon tires are slightly more efficient in braking than those of ordinary size, but this is not because of their increased cross section, but because of their lower inflation pressures. They do not cause the wheels to bump off the ground and being in continuous contact with the surface they have a greater drag.

Tests also showed that the greatest braking power was attained just at the point where the wheels started to slide, but while they were still revolving; when sliding at ordinary car speeds the braking effectiveness is reduced. Service brakes were much more efficient than hand brakes as the latter have been designed primarily



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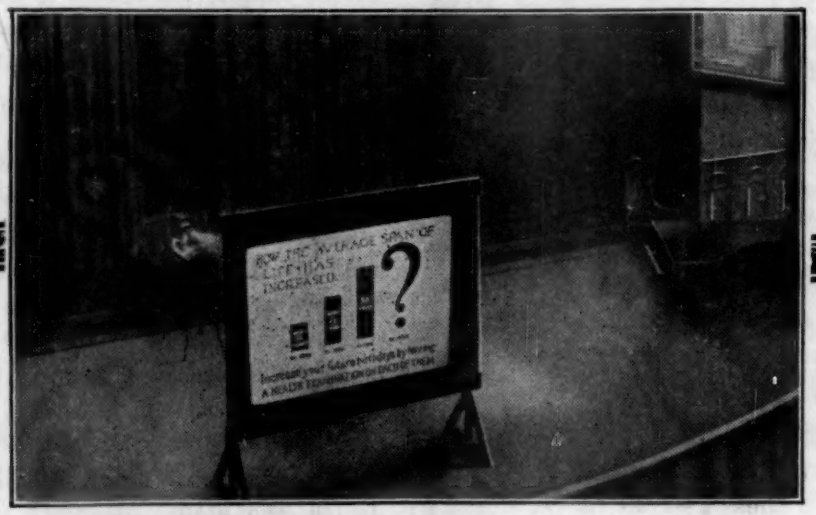

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only to hold the car stationary when standing on a grade.

The different times required for drivers to obey orders to set their brakes are held by the investigators to make the old-fashioned methods of brake testing quite inaccurate. The average time required was found to be about half a second, or a matter of 15 feet with a car moving at only 20 miles an hour.

SAFETY IN THE COAL MINES

PRACTICALLY 100,000 miners have been trained by the Bureau of Mines in mine-rescue and first-aid methods since the establishment of the bureau in 1910, states Director H. Foster Bain, in his annual report to the Secretary of the Interior for the fiscal year 1922–23. Whereas in 1910 the bureau trained 734 men, during the past year 14,941 men received the training, which was conducted in 35 States and Alaska.

Although the Bureau of Mines can say positively that wide-spread explosions of coal dust no longer should occur, the fact remains that they continue. In 1922 gas and coal-dust explosions took a toll of 311 lives, or 15.78 per cent. of the total deaths. Until the late series of disastrous explosions the lessening number of explosions in recent years had led the bureau to feel that the dangers from this source were being eliminated.

Two effective methods for preventing the spreading through a coal mine of a minor initial explosion have been demonstrated by the bureau at its experimental mine near Pittsburgh, where more than 500 experimental explosions have been produced and in which the explosibility of coal dusts from all parts of the country has been studied. The first method is to wet the dust so thoroughly that no dry dust remains in the mine. The second is to dilute the coal dust with shale dust, limestone dust, or other noninflammable dust so that flame will not pass from point to point.

From its years of study of coal-dust explosions the Bureau of Mines can say that great explosions should not be considered as normal occupational hazards. Explosions can and must be prevented from spreading throughout the underground workings of a mine. Miners and operators, as well as mine inspectors, must take hold of the situation promptly and vigorously or there will be still more serious explosions and more men killed.

The wide-spread attention given to the fatalities from explosions has resulted in the common supposition that gas and coal-dust explosions form the main hazards of mining, but the bureau finds that if the deaths from falls of roof and coal could be eliminated, the number of miners killed would be cut approximately in half. These deaths occur singly or in pairs in the dark recesses of the mine when a slab of slate falls or when coal at the face or in a pillar rolls over and crushes a worker. The deaths from roof falls aggregated 900 during 1922. The fact that this number is less than the total during several preceding years is due to thousands of men having been idle for several months during the bituminous coal strike.

The larger part of the responsibility for decreasing this class of accidents may fairly be placed on the miners themselves. Most of the falls occur at the working places and the miners there are better able to observe the conditions under which they work and to tell when the roof should be taken down or additional props put up than is any one else.

For the 11-year period that ended with 1922, 47.84 per cent. of all fatalities were due to falls of roof and coal, 16.85 per cent. were caused by mine cars and locomotives, 11.25 per cent. by gas and coal-dust explosions, 6.04 per cent. by explosives and 3.47 per cent. by electricity. During this period 25,975 men were killed in coal mines. Approximately 90 per cent. of all the deaths occurred underground, 2.29 per cent. were from shaft accidents, and the remainder, 7.59 per cent., occurred on the surface.

ITEMS

Science Service

THE best January yet for health is the verdict on last month rendered by the statistics of the Metropolitan Life Insurance Company covering their fifteen million industrial policyholders. Nearly every important cause of death registered lower mortality than in the corresponding month of 1923. The tuberculosis death rate, for example, dropped from 116.5 per 100,000 to 107.; that from organic heart disease from 159.7 to 135.9; the Bright's disease mortality fell from 81.9 to 71.4 and the rate for pneumonia from 133.8 to 122.6. Mortality from influenza was less than half that for January of the previous year and there was an appreciable drop in the mortality from diphtheria. For violent deaths, the record is not so favorable. Although lower rates have been recorded so far this year for suicide and homicide, accidental deaths have increased 8 per cent. and automobile fatalities were recorded in January at a rate of 12.9 per 100,000, as compared with 11.0 for the first month of 1923.

THREE new insecticides, two of them chemical and one mechanical, which are expected to be of great aid to farmers and fruit growers in their fight against insect pests, have been developed by the joint forces of the experts on insect fighting of the U. S. Department of Agriculture, of several states, and of the National Canners Association. They are calcium cyanide, nicotine dust and the aphidozer, the latter being the mechanical device, the others chemical. Calcium cyanide is made from lime and the nitrogen of the air and can be produced cheaply in large quantity. Nicotine dust is an application of the old-time tobacco dust, of which nicotine is the active principle. Both of these chemicals have been successful against the common pea-louse or aphid, against which the National Canners Association is waging a determined fight. This insect has given its name to the "aphidozer," a mechanical insecticide. This machine when driven through a field of pea vines sweeps off the troublesome aphids into a container, as much as eleven pounds of the plant lice having been collected from two and a half acres of peas.

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If vacancies occur, students from other institutions desiring advanced standing may be admitted to the second or third year provided they fulfill our requirements and present exceptional qualifications.

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Beginning Monday, June 2d, and ending Saturday, July 12th, a course in medical diagnosis, including laboratory exercises in clinical pathology and demonstrations in pathological anatomy, will be offered. The course will be limited to thirty students, fee $100. Applications should be made to the Dean's Office.

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Dean, Yale University School of Medicine

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SCIENCE NEWS

COORDINATED ENERGY

Science Service

How to find a way to harness the apparently chaotic and unpredictable energies of the universe and to transform them into forms of energy which can be studied mathematically, directed and controlled, was described as one of the great tasks of science by Professor M. I. Pupin, of Columbia University, in an address before the American Mathematical Society. Energy that can be mathematically studied he termed "coordinated," while all the other forms he called "non-coordinated." A steam boiler was given as an illustration of the first, and a star, or a molecule, is an example of the second source of energy.

"'Hitch your wagon to a star' and you will get somewhere is the promise of the poet," said Dr. Pupin, "but if you should hitch your wagon to a molecule, which in its motion changes its schedule a countless number of times during every brief moment of its erratic history, you will get nowhere. If, however, you hitch your wagon to a steam engine which is driven by a countless number of erratic molecules of the boiling fluid, the law developed by Carnot, the great French engineer and scientist of Napoleonic times, will predict with mathematical accuracy the path of the coordinated motion of your vehicle."

The earth as a whole is able to transform and coordinate the immense amount of energy received from the sun, Dr. Pupin said.

"Most of us are familiar with the selectivity of radio receiving instruments. We select from many messages, the one the wave length of which is in tune with our receiving apparatus. Mathematics tells us that the material structures on the earth receive the radiant energy of the sun because the molecular elements of these structures are electrically in tune to some particular wave length of the innumerable, non-coordinated electrical waves sent us by myriads of solar atoms, each of them being essentially an independent station for broadcasting its own share of solar energy.

"From the non-coordinated activity of the fire under the boiler to the coordinated activity of the steam engine, there is the same progress which reveals the same universal truth as the progress from the non-coordinated solar activity to the coordinating activity of organic structures on earth."

PERMALLOY

Science Service

PERMALLOY, the nickel-iron alloy invented last year in the laboratories of the Western Electric Company, is to be used in the construction of the new cable to be laid by the Western Union Telegraph Company from New York to the Azores. The order followed the success of tests made with 120 miles of experimental "permalloy" cable off Bermuda last summer. The new cable differs from the old only in having a thin permalloy tape wrapped around the copper wire beneath the guttapercha insulation. It is expected to have a traffic capacity four times that of existing cables of the same size.

The invention of "permalloy" and "permalloy loaded cable" is possibly the most important development in the whole history of cable construction since the first trans-oceanic cable was laid. It has unusual significance, for it is the first radical change in cable construction in more than fifty years.

The new invention may mean the construction and laying of direct cables of a length hitherto impossible on account of costs or limit of traffic capacity. In fact, the possibilities of the new cable from a traffic-carrying standpoint seem to be such that direct cables could be laid over much longer routes than there is any commercial necessity for.

While this new cable using permalloy does not forecast the replacement of any existing means of trans-oceanic communication, the fact that it offers a very large increase in traffic capacity over long distances will undoubtedly result in a realignment of the fields of various kinds of world communication. Its introduction will tend to clarify the situation regarding the dividing line between the real fields of radio and cable in trans-oceanic communication.

The new metal, "permalloy," is composed of about 80 per cent. pure nickel and 20 per cent. pure iron. It is the most easily magnetized and de-magnetized of all metals. This gives it peculiar value in submarine cable work where large magnetic effects are desired from small currents.

CHEMICAL INVENTIONS

Science Service

WOULD-BE inventors who think everything of value has already been invented might find solace in the consideration of a report on present research problems by Dr. J. E. Zanetti, of the National Research Council, to be published in the next issue of the *Journal of Industrial and Engineering Chemistry*. The list of problems, the solution of which would be eagerly welcomed by the scientific or technical world, numbers one hundred.

While many of these are not of apparent immediate practical application, there are some which might bring wealth as well as fame to the inventor. Here are some of the more practical problems:

A study of the effect of a base metal upon the metal electroplated upon it; a general study of the use of barium cyanide in improving copper plating; a method for finding the degree of adherence of electroplated metal; a method for electroplating a steel spring without causing it to lose its springiness.

The whole study of corrosion is open to the inventors and investigators. Just what is the effect of impurities on the rate of corrosion of copper; and why does a small amount of "water-glass" prevent the corrosion of aluminum and other metals.

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Post-doctorate fellowships in the Biological Sciences (Zoology, Botany, Anthropology, and Psychology) will be assigned by the Board of National Research Fellowships in the Biological Sciences for the academic year 1924–25 in the spring and late summer of 1924. The spring meeting will be held April 23rd. Appointments may date from July 1 or later. Forms of application and statement of conditions will be furnished by letter or by wire on application to the Secretary, Board of National Research Fellowships in the Biological Sciences, National Research Council, Washington, D. C.

For the benefit of those who may not have seen the notices of these Fellowships earlier, the period in which applications may be received has been extended to April 15th, but they may be sent at any time for later consideration.

Liquid ammonia and liquid sulphur dioxide are coming into commercial use as solvents. Information is wanted on all phases of the problems connected with the use of these substances in this connection.

Much remains to be learned about rubber. The behavior of pigments in rubber, the plasticity of unvulcanized rubber, the solubility of rubber, what causes it to "age" after vulcanization; and many other questions of its chemical action and composition are awaiting the trained investigator.

Paints, cellulose, paper, are but some of the other common raw materials of industry about which much is to be learned. The inventor still has his chance.

METHODS OF IMMUNIZATION

Science Service

THE possibility of vaccinating against certain diseases by eating the dead germs or rubbing them on the skin is suggested by Professor A. Besredka, a Russian working on the staff of the Pasteur Institute, Paris, as a result of experiments upon animals and subsequently with human beings. His conclusions are considered revolutionary in their application to the prevention of disease.

Professor Besredka asserts that immunization is effected by bringing the immunizing substances into contact with the tissues where the disease to be protected against usually first enters the body, rather than by injecting them under the skin.

For example, it was found that guinea-pigs could be protected against anthrax, a disease to which they are especially subject, by applying killed anthrax germs to the surface of the skin, where the active germs usually first find lodgement. This immunity is not associated, Professor Besredka states, with the presence of antibodies in the blood, usually considered to be necessary to immunity.

Experiments with cholera, typhoid and dysentery, all diseases which enter the body through the walls of the intestines, have shown that protection may be obtained by administering the vaccines by the mouth, the immunity resulting, according to Professor Besredka, from the effect of the vaccines on the intestinal cells rather than on the blood.

Data have been collected which may be interpreted as indicating that persons in contact with cases of typhoid or dysentery may be protected by eating tablets containing killed bacteria. An investigation of the possibility of protecting against cholera by this method is to be undertaken in Russia by the health section of the League of Nations.

Another possible application is that of vaccinating the skin against invasions of the bacteria known as staphylococci, which cause boils. Evidence is accumulating that protection may be effected by applying the vaccines to the skin instead of the usually accepted procedure of inoculating them under the skin.

Professor Besredka's views are considered revolutionary, and if confirmed by further experience, of the highest practical importance in the prevention of disease. Inoculation of vaccines frequently causes considerable local irritation and in some cases actual illness; practically all of which is avoided by eating the vaccines or rubbing them on the skin. For these reasons it is expected that it will be easier to persuade people to be vaccinated than is the case with the present methods of inoculation. The new method of protecting against disease is not yet ready for general public health application.

ITEMS

Science Service

THE largest vessel to be driven by Diesel oil engines has been ordered by the Union Castle Mail Steamship Co., for their South African service. It will be a 20,000 ton twin screw passenger liner and will be built by Harland and Wolff, Ltd., at Belfast, according to information received here by "Power." The vessel will be by far the most powerful motor ship in the world and the most powerful yet designed. It will be equipped with two sets of double-acting, eight cylinder Diesel internal combustion engines, developing approximately 20,000 indicated horsepower, through the use of crude oil. Pumps for circulating salt water, fresh water, and lubricating oil will be electrically driven as will all the auxiliaries. Electric power will be available for heating and cooking.

THE leather industry in the United States will have to depend more and more upon foreign tanning material of which the forests of South and Central America have an almost inexhaustible supply, says Otto Wilson, former chief of the Latin-American division of the Department of Commerce, in an article to appear in the next issue of the Chemical and Metallurgical Engineering. One third of the natural tanning material now used in this country is imported, the article states. The ready sources of home-grown tanbark have been depleted through deforestation and through the chestnut tree blight which has killed off 80 per cent. of the available supply of chestnut trees, and threatens their complete destruction. Chestnut bark has been in recent years the largest single source of vegetable tannin. Large reserves of tannin still exist in this country, principally in the hemlock forests of the Northwest, but they are economically unavailable at present.

METHYL alcohol, otherwise known as wood alcohol or methanol, is now being made by the chemical combination of carbon monoxide gas and hydrogen at the great German chemical factory of the Badische Anilin und Soda Fabrick at Ludwigshafen according to advices received in scientific circles. The manufacture of this essential raw material in many chemical industries is now effected on the large scale by the direct union of the two gases in the presence of an activating substance or catalyst. The gas mixture is heated to a high temperature and subjected to high pressures. Enough methyl alcohol is now being produced, the reports state, to provide for all of Germany's requirements. Among its uses is that of raw material for the manufacture of formaldehyde, which in turn is used as raw material in the making of artificial resins. Since carbon monoxide gas and hydrogen are made by passing steam over red-hot coals, wood alcohol may now be said to be produced from those simple substances.

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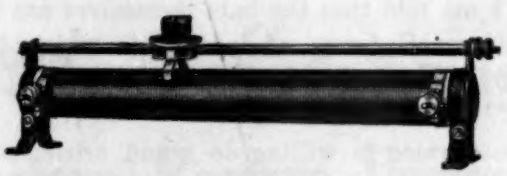

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THE OBJECTS OF SCIENCE SERVICE

Science Service

MANY scientists are wondering whether the purpose of Science Service is to disseminate scientific news in a readable and interesting form, or to disseminate propaganda. A recent explanation of policy by the editor is not at all satisfactory, especially as applied to the particular case he was explaining.

Again, in the issue of February 8 (SCIENCE, LIX, pp. xii–xiv), we find definitely designated as "gizzard stones" the gastroliths frequently associated with dinosaur bones which have long been known to and extensively discussed by zoologists and paleontologists. No new facts are presented, but a theory is accepted and promulgated in a positive form, without even a mention of another theory quite generally held by naturalists. It is definitely asserted that the stones were used by the dinosaurs in grinding up their food "after the manner of modern birds and fowls." The purpose of pebbles in the gizzards of such birds as have such organs is known, but gastroliths are found in the stomachs of many animals which have no gizzards, being especially common in the stomachs of seals and sea-lions, and not uncommon in certain lizards, snakes and fishes. A bull-snake recently dissected by Mr. E. T. Engle at the University of Colorado contained one pebble 38 × 29 millimeters in diameter and two smaller ones.

Also the unqualified statement that birds are "linear descendants" of dinosaurs will incline many to wonder just who proved it and how. The term has very exact significance and the relationship it suggests has certainly not been demonstrated in this case.

In the same issue Science News, in discussing the great Carlsbad caverns of New Mexico, definitely states that bats "are now the only inhabitants of those vast regions of subterranean gloom." That certainly is not supported by any real evidence. There has been no biological exploration of the caverns such as would be necessary to form the basis of such an assertion. Biologists will be very reluctant to believe that caverns so extensive and so ancient as these are said to be are devoid of a genuine cave fauna, and they will not believe it unless future quite thorough investigation by competent trained biologists fails to reveal such a fauna.

Science Service is an excellent institution, but its value would be greatly enhanced if one could feel that it is to be kept as free as reasonably possible from inaccurate statements and dogmatic assertions concerning matters which are uncertain or unproved. Loose, doubtful and inaccurate statements are not necessary in order to make science news readable and interesting to both the scientific and unscientific reader.

UNIVERSITY OF COLORADO JUNIUS HENDERSON

THE criticism of the Science Service item "Gizzard stones of dinosaurs exhibited" by Professor Junius Henderson is, like other criticisms, based upon a misunderstanding of what Science Service aims to do.

Science Service is prohibited by its charter from carrying on propaganda, but its field would be extremely limited if it were confined to those views on which all scientists were agreed.

Our *Daily Science News Bulletin*, which is prepared for the daily papers, and in part published in SCIENCE, is intended to present scientific "news" and therefore must deal with controverted subjects. Science Service is merely a reporter and it does not have either the knowledge or the right to refute the theories or revise the statements made to us by the authorities we report. The information for both the articles criticized by Professor Henderson came as was stated, from Dr. Willis T. Lee, of the United States Geological Survey. The points to which Professor Henderson takes exception are literal quotations from Dr. Lee's statement. I had no right to alter his words even if I had wanted to. What would Professor Henderson have me do? Should I have put an asterisk after the words "fowls are the linear descendants of dinosaurs and since the fowls use pebbles in their gizzards to grind their food, it is not strange that their ancestors did the same," and appended a footnote reading "so he said, but I don't believe it."

It happens that I did have an opinion on the question of the gastroliths, for I helped Dr. Williston hunt saurians in the chalk beds of Kansas in 1891, in each of which a quantity of gastroliths were found, but I should have no right to interpolate my views in another man's statement.

A fuller report of Dr. Lee's exploration of the Carlsbad Cavern was published in the *National Geographic Magazine* for February. When I called Dr. Lee's attention to Professor Henderson's criticism of his remark that "bats are now the only inhabitants of those vast regions of subterranean gloom" he frankly acknowledged his "error of omission" and added "There are other inhabitants of the cavern which I overlooked. I am told that the bats themselves are inhabited by certain small forms of insect life which I am not personally familiar with and therefore neglected to mention."

Science Service is willing to stand criticism for any mistakes it makes in presenting the views of scientific men and translating scientific articles into ordinary language, but it is not fair to criticize Science Service where it has carried out correctly and conscientiously its duty of reporting and translating.

It is unfortunate for us that duty sometimes requires us, like Red Cross nurses, to work between the firing lines of scientific controversy, but in case we get hit we can, like Red Cross nurses, console ourselves with the reflection that the bullet was not really intended for us, but it was aimed at the opposite side. But I wish they would shoot straighter. In every case so far where our news items have been criticized in SCIENCE we have found on looking up the manuscript that the statement objected to was a literal quotation or a fair paraphrase of the authority cited. This, I respectfully submit, is a good record, considering that Science Service is now producing for the public press more than ten thousand words a week. If more scientific men would aid us by supplying us with early and authentic information it would be more helpful to the cause than *ex post facto* criticism.

EDWIN E. SLOSSON,
Director of Science Service

Cornell University Medical College

First Avenue and Twenty-eighth St.

NEW YORK CITY

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Johns Hopkins University

Medical School

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As the number admitted to each class is limited, applications must be made before July 1.

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SCIENCE NEWS

THE COMPOSITION OF ANTIMONY

Science Service

ANTIMONY, the brittle metal used by printers to impart hardness to type, seems to be a mixture of metals, and not a single chemical element, as the books tell us. The ingredients are the so-called "isotopes," which are identical in chemical behavior, although they differ in a few physical properties.

According to data from the Cambridge metallurgical laboratory, antimony from Hungary is apparently composed of atoms which are lighter than those in samples received from Bolivia. The difference is only one per cent., however, a quantity which never will trouble the printer, but which provokes the analytical chemist who can not make his antimony analyses agree with published professional standards. The atomic weight value obtained in preliminary work with Hungarian antimony is 121.1, and with Bolivian metal 122.4.

Ages ago, when chaos was becoming cosmos, most of the twin and triplet elements, or isotopes, were very intimately mixed. Chlorine, for example, is undoubtedly a mixture of substances; but so thorough was the mixing process that chlorine from all parts of the world now has a constant composition. Thus chlorine for all practical purposes plays the rôle of a single element. Antimony, however, does not seem to have been so carefully mixed in the melting pot.

RUBBER AND WATER

Science Service

A METHOD of dispersing rubber in water in such a way that it can be used for coating fabrics, making paper, treating leather, doctoring trees, making chewing gum and many other articles has been patented in Italy by William Beach Pratt as a result of work at his laboratory at Wellesley, Mass.

Crude or coagulated rubber is brought into suspension by the new process with such completeness that the dispersed solution is substantially the same as the original rubber latex from which the crude rubber is coagulated.

Last year several rubber factories began to import and use rubber as liquid latex rather than in the solid form, claiming that it is possible to use it more economically and with better results for coating fabrics. The new process developed by the Pratt laboratory is claimed to have the advantages of the latex without the extra cost of transportation due to its liquid form.

It is possible to compound with the crude rubber before dispersion any desired fillers, oils, sulphur, accelerating agents and similar compounds. This allows vulcanization of such rubber compounds. Inflammable, dangerous and costly solvents, such as benzol, now used in making solutions of rubber, are not needed in the new process, but soaps and glues are introduced into the spaces between the rubber particles and cause small globules of rubber to become dispersed in the water.

Among the ways in which the new water dispersed rubber can be used are: It can be spread upon fabrics, which, after removal of the water, can be used in the manufacture of tires, hose, rain coats and vehicle tops, or boots and water proof garments. It can replace the ordinary rubber cement made with organic solvents.

With additions of oils and waxes, or alone, it can be mixed with pulp in making paper or can be spread on the surface of cardboard or paper, and then vulcanized. Leather can be filled or coated with it. Wounds in trees can be covered with a paste made of the new rubber compounded with substances toxic to insects. It can be used as binder for ground leather, cork, asbestos, cotton and other materials and the compound applied with a trowel. A rubber chewing gum can be made by incorporating with the dispersed rubber sugars, waxes, gums and flavors.

SEASONING LUMBER

Science Service

ARTIFICIAL seasoning of lumber so effective that within three days after a tree has been felled in the forest its wood is made ready for the finest cabinet work has just been perfected in Sweden. The process is known as Forselle vacuum drying, and consists essentially of running logs into a large cylinder in which a vacuum is created by pumping.

Logs fresh from the stump are placed in the Forselle cylinder, which accommodates about 3,600 board feet at a time. A centrifugal pump is then brought into action, which gradually creates a vacuum drawing off the moisture evenly and simultaneously both from the heart wood and the sap wood of the logs. Since the escaping moisture keeps the surface of the log wet during the process no cracks are formed, and, indeed, already existing cracks are closed up. Experts who have observed the tests report that after 48 hours of drying most of the samples were ready for immediate use. Incidentally there is no weakening of the fibers in spite of the high rapidity of drying.

The practical value of the Forselle process is evident in all work where time is an important factor, as in the construction of air craft or naval vessels. It also eliminates the cost of storage, piling, insurance, etc., which accumulate when timber has to be kept in the yard during long periods of time.

Drying plants of this type are to be installed within the near future in Finland and Japan as well as Sweden. The present cost of operation is estimated at a little more than $1.00 per thousand board feet.

FAKE PSYCHOLOGISTS

Science Service

CHARGING that many lecturers and so-called schools are exploiting unscientific beliefs and practices under the guise of psychology, the National Committee for Mental

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Post-doctorate fellowships in the Biological Sciences (Zoology, Botany, Anthropology, and Psychology) will be assigned by the Board of National Research Fellowships in the Biological Sciences for the academic year 1924–25 in the spring and late summer of 1924. The spring meeting will be held April 23rd. Appointments may date from July 1 or later. Forms of application and statement of conditions will be furnished on application by letter or by wire to the Secretary, Board of National Research Fellowships in the Biological Sciences, National Research Council, Washington, D. C.

For the benefit of those who may not have seen the notices of these Fellowships earlier, the period in which applications may be received has been extended to April 15th, but they may be sent at any time for later consideration.

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13th Edition, Published December, 1920

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Hygiene has issued a warning against fake psychologists.

"Much that is to-day called 'psychology' is misnamed," the committee says. "Perhaps no word is more abused. It should not be confused with phrenology, spiritism, faith-healing, self-improvement by magic, psychic phenomena and the like. Psychology is the science of human behavior.

"As often happens in the development of a new science, many people have seized upon the opportunity to gain support for their unscientific beliefs and practices. The exploiters of the present interest in psychology may be roughly grouped as follows:

"First, there are certain lecturers who are going about the country organizing classes or advertising 'self-improvement' courses in the name of psychology.

"The second group consists of those correspondence courses that make extravagant claims for developing the mind and the will. These courses, whose charges, we understand, run from $30 to over $100, are alleged to be doing a land-office business.

"Then there are special book publishers, who write and issue sets of books, ranging in price from $10 to $30 a set, and some magazines purporting to discuss psychological subjects, which have a wide circulation.

"It is conceivable that some, at least, of the 'students' of such courses are inadequate personalities, who, from physical or other causes, are unable to compete successfully with their fellow-men, and see in these courses, lectures and literature a cure-all for their troubles. In some instances no harm may result. But when a false sense of security postpones needed medical or psychiatric treatment, disaster is sure to follow. For these persons to resort to courses, lectures and literature would seem about as effective as for them to carry a horse-chestnut, rabbit's foot or other charm in their pockets."

THE ISOLATION OF VITAMINS

Science Service

ONE of the vitamins, the mysterious and unisolated food factors, has at last been obtained in a state of such purity that its early identification may be anticipated with certainty.

Dr. Atherton Seidell, chemist at the U. S. Public Health Service Hygienic Laboratory at Washington, has announced that he has been able to prepare from brewer's yeast a definitely crystalline compound that has the antineuritic properties of vitamin B.

He used fuller's earth to absorb from a solution of yeast the active vitamin principle and after precipitating with picric acid and subjecting this product to many solutions and crystallizations, pale yellow, transparent, crystalline flakes were obtained that in doses as minute as two milligrams a day protect pigeons from the effects that follow lack of vitamin B.

When a chemist obtains a crystalline substance it is usually only a matter of time until its identity can be established and its true chemical structure determined. With this information its synthesis frequently becomes possible.

"There has been a tendency in the past to regard vitamins as substances comparable with enzymes and toxines in their stability and marked activity of infinitesimal doses," said Dr. Seidell. "Acceptation of this view has, no doubt, deterred many from work on this problem, since the possibility of isolating substances of the nature of enzymes is very remote. It is distinctly encouraging, therefore, to obtain evidence that the antineuritic vitamin performs its function in doses of convenient magnitude and withstands ordinary laboratory manipulations. Assuming a satisfactory demonstration of these points, the final solution of the true chemical nature of vitamins may be anticipated with certainty."

BODILY BUILD AND DISEASE

(Science Service)

DIAGNOSIS of disease from the physical build of the patient may become a reality if the conclusions reached by Drs. George Draper, Halbert L. Dunn and David Seegal of the Presbyterian Hospital, New York, become generally confirmed. The "consumptive build" or the "bilious countenance" may be accepted as scientific realities.

Measurements made of 50 patients with gall-bladder disease, and of 39 patients with ulcers of the stomach or intestines have shown that those who suffer from one complaint have on the average a different physical build from those who suffer from the other. The diagnoses in all these cases were confirmed at operation. About 85 separate measurements were made on each individual.

Gall-bladder patients were generally heavier for their height than those afflicted with ulcer, had greater chest depth, a wider and squarer upper jaw, and showed other marked differences. The method offers confirmatory evidence in cases of doubtful diagnosis.

The physicians who made these investigations do not believe that a given physiological form "in itself predisposes to or actually causes disease," but merely that physical features express inherited influences and predispositions. Aside from their value in finding out what is the matter with sick people, these measurements made upon well persons will be a guide to them as to what diseases they have particular reason to guard against.

These first reported scientific measurements were made of the new "Constitution Clinic" of the Presbyterian Hospital which has been established for the purpose of finding out the relations betwen the bodily structure, the body functions, the mental processes, and immunity and susceptibility to disease.

THE EFFICIENCY OF PROOFREADERS

Science Service

A PROOFREADER overlooks a greater number of mistakes on the right, vertical portion of a proof sheet than he does on the left, according to Dr. H. R. Crosland, assistant professor of psychology at the University of Oregon, who has just completed a two years' investigation into the causes of errors in proofreading. This is claimed to be the first thorough-going scientific investigation of its kind.

Dr. Crosland also discovered that there will be a

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H. J. Gerstenberger (Amer. Jr. Dis. Child., Oct., 1923) has described nine cases of Herpetic Stomatitis and Herpes Labialis, all of which were improved and cured by feeding Yeast Vitamine-Harris Tablets.

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Prepared by

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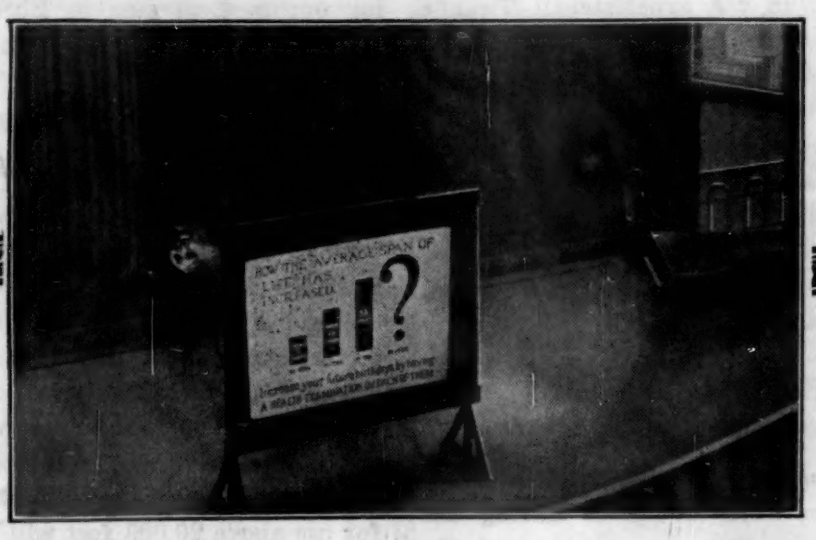

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greater number of errors overlooked in the lower half of the sheet than in the upper half. This is caused, he explained, by the tendency of the proofreader to become absorbed in what he is reading as he nears the end of the proof sheet, and also by fatigue.

Proofreaders show no appreciable improvement in accuracy as the result of practice and experience, according to the investigator. This was attributed by him to the fact that in reading a line of type the eye passes from one fixation pause to another and does not directly focus on every character in that line. The length of fixation pause, the number of letters spaces taken in by the eye during each pause, and the number of pauses per line, are all the result of heredity and very early environment. Therefore it follows that practice has little to do with the proofreader's ability to catch mistakes in printed matter.

Dr. Crosland found that it is not necessary to spend an undue length of time on a proof. "In fact, little kinship exists between the lenth of time spent in reading a proof sheet and the accuracy obtained by the reader," continued Dr. Crosland. "Indeed, there is evidence to show that the practiced proofreader takes too long to do his work."

The investigator believes the use of his tests will be of practical vocational value. In the course of his investigations he found he was able to predict with a high degree of accuracy the competitive rating which a given subject would make in a given series of the test by considering his record in the series already taken.

Thirty persons, consisting of journalism teachers, all of whom had previous newspaper experience, printers, and laymen were engaged in the experiment. Twenty proof sheets were read by each person, an interval of approximately one week elapsing between the reading of each sheet. The proof sheets were grouped in four series and each of the four series was read with a certain purpose in mind. Readers were instructed to read for (1) accuracy, (2) for speed, (3) for meaning, and (4) with a stated time limit.

Thirteen em proof sheets, the usual newspaper column, were employed in the tests.

AMERICAN MEDICAL SCHOOLS

Science Service

GREATER progress in medical education has taken place in America than in other countries during the past fifteen years, Abraham Flexner, secretary of the General Education Board, said in an address before the Annual Congress on Medical Education in Chicago. But conditions are still far from entirely satisfactory, his survey indicated.

"Relatively viewed, progress in this country has been enormously greater than anywhere else," Mr. Flexner said. "It affects every item that goes to make up a medical school. There were one hundred fifty-odd schools, so called, in this country fifteen years ago. That number has been practically cut in half. The weak schools in all sections of the country, particularly in the South and West, where they were most abundant, have been almost wholly eliminated."

Equipment, facilities, teaching and standards of admission have been improved, but he attributed the relatively quicker and greater progress to the fact that we had further to go than other countries.

The differences between what was good and what was bad were in America ten years ago far more marked than was the case in any other country of the Western World. Things were so excellent in Germany, Denmark and Switzerland that very great progress was not to be expected and could not take place in so brief a term. In England and France, on the other hand, great general progress would have been possible, but it was not made. America, worse off than any of them, bestirred itself actively.

Discussing the requirement of four years of high school education followed by two years of college work for entrance to medical schools, Mr. Flexner pointed out that the great differences between high schools and colleges in various parts of the country make such requirements practically meaningless, as compared with the more definite standard indicated by the certificate of graduation from the German Gymnasium, a French Lycée, or the honors course of an English secondary school.

Our student body, is, as a whole, at a higher level of maturity and training than was the student body ten or fifteen years ago because fifteen years ago there was no general requirement even in name. But it is still much more heterogeneous than that of any other nation in the world.

Mr. Flexner urged better faculty and facilities for clinical teaching and a return to the old habit of sending our medical men to Europe for a couple of years of medical study and research in European centers.

ITEMS

(Science Service)

THE new expedition to conquer Mt. Everest, the highest peak of the Himalayas and the highest mountain in the world, will leave Darjeeling in northern India towards the end of March. It will be commanded by General C. G. Bruce, who commanded the expedition that almost achieved the goal last year, being forced to turn back when only 2,000 feet below the summit. More than half of the expedition will be composed of those who took part in the effort last year. A new type of oxygen apparatus for use above 20,000 feet will be used. The final attempt on the summit will be made toward the end of May.

A LARGE deposit of soapstone has been found on the shores and islands of Trap Lake in the Kenora district, about 200 miles east of Winnipeg. The deposit is remarkable in that it is of great extent and because it outcrops from 8 to 15 feet above the surface. It is believed that there are more than 1,000,000 cubic feet of the material above the water level. Transportation facilities are excellent. Soapstone is coming into wide use, owing to its capacity for absorbing heat. It is employed in fireless cookers and electric irons. Because of its resistance to acids it is largely used in the manufacture of laboratory and sanitary fittings.

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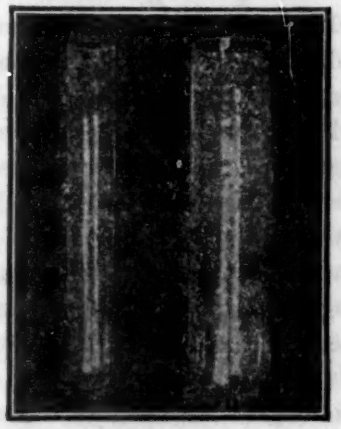

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SCIENCE NEWS

PHOTOGRAPHS OF ELECTRICAL DISTURBANCES

Science Service

ELECTRICAL disturbances lasting only a few billionths of a second can be made to record themselves on a photographic plate, without light, according to a discovery announced by J. F. Peters, electrical engineer of the Westinghouse Electric and Manufacturing Company. Mr. Peters believes that the application of this discovery will be of great importance to electric transmission engineers.

The instrument used to obtain the photographs consists of a suitable plate holder for receiving ordinary photographic plates, provided with suitable electrical connections so that electrical disturbances may be brought into contact with the sensitized side of the plate.

When surges occur in the transmission line they photograph themselves. The surges may last twenty billionths of a second, so that the photographic plate must register them in that minute space of time. Mr. Peters states that he has never yet detected visible light in the camera while photographing a surge and that therefore the impulses must contain some property in themselves that affects the plate. The prints obtained from such plate exposures show many geometrical figures of beautiful shapes and also take on certain definite forms according to the character of the voltage at the time the surge or impulse occurred. It is possible to tell from the developed plate whether the voltage at the time of the surge was positive or negative, whether it was alternating or unidirectional, and its direction and intensity.

Positive, negative and oscillatory surges produce figures having quite different configurations. The voltage is shown by the diameter of the figure photographed, and the time is indicated by its position on the sensitized chart that moves at known speed. The direction of the surge is shown by comparing the configurations of figures from two instruments, one connected from line to the ground, the other connected across an inductance that is in series with the line.

The photographs obtained are of great importance to transmission engineers, since the instrument for taking the photographs is the only practical device yet devised for obtaining data in regard to that type of line disturbances known as surges. Heretofore engineers have only known that surges occur, but where they occur and their nature has been largely guess work. The photographic plate now gives the characteristics of surges, thus giving the engineers data with which to devise line protection. The instrument will do much to enable the engineering profession to increase the reliability and continuity of service on existing power lines. The device is applicable to transmission lines of all kinds and is connected to them by means of an electrostatic potentiometer.

In early tests Mr. Peters used a condenser discharge to stimulate the condition that occurs during the period of a surge. From these discharges were obtained his first photographs of electrical impulses. Tests were made later with the instrument connected directly on a transmission line.

THE EXPLORATION OF THE ATMOSPHERE BY A FREE BALLOON

Science Service

THE first of fifteen flights in a free balloon which will ride the storms in an effort to learn more about them is about to be begun by Dr. C. LeRoy Meisinger, of the central office of the U. S. Weather Bureau. The flights are part of the most ambitious plan for scientific exploration of the atmosphere so far undertaken and they will be carried on through the cooperation of the Weather Bureau and the U. S. Air Service.

The flights will all start from Scott Field, Ill., not far from St. Louis. They will be made in a hydrogen-filled balloon, furnished and piloted by the Air Service, and equipped by the Weather Bureau with a full set of meteorological instruments. The first flight will begin about April 1. The balloon will be a large one, about 40 feet in diameter and holding 35,000 cubic feet of gas.

The main purpose of the flights is to study the motions of large masses of air with reference to the ground, when they are influenced by the great whirls in the atmosphere, hundreds of miles in diameter, which the meteorologists call cyclonic storms and which in their passage across the country give us most of the many varieties of our weather. The motion of the air with reference to the centers of these storms is fairly well known, but these centers are always themselves in motion and just what happens to the air in them or above them is not understood.

Dr. Meisinger proposes to find out by going up in a balloon in the storm to a height of 10,000 feet, and then sticking by it as long as it is possible to do so, mapping out his location from time to time, and at the end charting the whole voyage, which will give the track not only of the balloon, but also of the air in which it rode. He will take some trips in front of storms, some near their centers, others trailing behind them, and will study the behavior of the air in each case.

Observations will be made of the amount of dust in the atmosphere and of sky brightness, things of great practical importance to the aviator through their effects on visibility. An attempt will be made to measure the size of water drops when passing through the clouds.

Communication with the ground will be maintained during the flights by radio and carrier pigeons. The pigeons will carry messages from the balloon to the base at Scott Field, while incoming messages will be handled by a radio receiving set. Dr. Meisinger will receive weather bulletins twice a day from the central office of the bureau, arrangements having been made with fifteen broadcasting stations to broadcast the bulletins. The stations used will depend on where the storms happen to be carrying the balloon.

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NATIONAL RESEARCH FELLOWSHIPS IN THE BIOLOGICAL SCIENCES

Post-doctorate fellowships in the Biological Sciences (Zoology, Botany, Anthropology, and Psychology) will be assigned by the Board of National Research Fellowships in the Biological Sciences for the academic year 1924–25 in the spring and late summer of 1924. The spring meeting will be held April 23rd. Appointments may date from July 1 or later. Forms of application and statement of conditions will be furnished on application by letter or by wire to the Secretary, Board of National Research Fellowships in the Biological Sciences, National Research Council, Washington, D. C.

For the benefit of those who may not have seen the notices of these Fellowships earlier, the period in which applications may be received has been extended to April 15th, but they may be sent at any time for later consideration.

THE MICROSCOPE

By SIMON H. GAGE of Cornell University

13th Edition, Published December, 1920

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This is the first time that an attempt has been made to study the behavior of storms at first hand, and the information which Dr. Meisinger expects to get will be of great importance in the study of the causes of the formation and continuance of storms, and so of service in forecasting.

Although the flights will be made in a hydrogen-filled free balloon, Dr. Meisinger is looking forward to a pleasant series of trips in the air. He even considers the looking down on the top of a tornado from a safe distance as an interesting possibility. The only things he considers as really unsafe are thunderstorms, and the possibility of alighting in the water, but the flights are not sporting events and no risks will be taken.

BETELGEUZE

Science Service

No star in the heavens has been more before the public eye in the past few years than ruddy Betelgeuze in Orion, which now shines so brilliantly in the southwest in the early evening. Betelgeuze leaped into fame in the winter of 1920 when, chosen as the object of the first test in measuring the diameters of the stars with the Michelson interferometer attached to the 100-inch telescope of the Mt. Wilson Observatory, it was found to have a diameter of over two hundred million miles.

Betelgeuze is not only a giant, however. It is a most erratic giant. Later measurements with the interferometer showed variations in its diameter such as have not been found in the measurements of the diameters of other giant stars with the same instrument. This fact taken in connection with the fact that Betelgeuze has long been known as a star that varies irregularly in brightness makes it appear that it is irregularly contracting and expanding in size, pulsating, like some mighty heart of the heavens. The brightness apparently increases with contraction and decreases with expansion of the star.

Betelgeuze is now at its maximum brightness. It is more brilliant than Rigel, the bluish-white star in Orion diagonally opposite to it, toward the southwest, and it has been rivaling and at times surpassing Capella, the beautiful golden star in Auriga to the northwest of it. It is also much brighter at the present time than it was a year ago. When at its maximum brightness it is decidedly inferior to Aldebaran which is in the V of the Hyades in Taurus to the northwest of Orion and which to the ancients represented the baleful, red eye of Taurus the Bull. At maximum brightness Betelgeuze is over three and a half times more brilliant than it is at minimum brightness, and the change may take place within a year or less.

Aside from the fact that the diameter of the star is changing continually as a result of its irregular contraction and expansion, there is an additional uncertainty as to the actual size of Betelgeuze which results from the uncertainty as to its distance. To change the angular diameter, that is given by the interferometer, into miles it is necessary to know the parallax of the star which is simply the angular distance between earth and sun as viewed from the star. This value can be obtained in a variety of ways. According to the latest report from the Mt. Wilson Observatory, the best value of the parallax of Betelgeuze is seventeen thousandths of a second of arc. That is how far apart in angular measure the earth and sun would be at the distance of Betelgeuze. This value gives 190 light years as the distance of Betelgeuze from the earth and a diameter for the star of 245,000,000 miles.

Very recently the parallaxes of over one thousand stars have been determined at the Dominion Astrophysical Observatory at Victoria, B. C., with the 60-inch reflector by the spectroscopic method, and in this list we find for Betelgeuze a parallax of one hundredth of a second of arc, which would place Betelgeuze at a distance of about 325 light years and give the star a diameter of over 400,000,000 miles. It is possible, then, that Betelgeuze may be even larger and more distant than earlier estimates have made it. It is probable that its size has been underestimated rather than overestimated and it may closely rival if not surpass Antares which is estimated to have a diameter of about 400,000,000 miles.

With the value of the parallax found at the Dominion Astrophysical Observatory the actual brightness of Betelgeuze comes out about five thousand times that of the sun. If the sun and Betelgeuze were placed side by side at a distance of thirty-three light years from the earth the sun would appear as a faint star of the fifth magnitude but Betelgeuze would be as brilliant as Venus as it now appears in the western heavens.—*Isabel M. Lewis.*

THE BLUE COLOR OF THE ATMOSPHERE

Science Service

THE blue color of the atmosphere is caused by a stratum of frozen, crystalline nitrogen in extremely high altitudes, according to theories recently put forward by Dr. L. Vegard. The aurora borealis and zodiacal light are attributed by him to the same cause.

Dr. Vegard asserts that there is some point in the upper atmosphere where the temperature must fall as low as 350 degrees below zero Fahrenheit. If so, nitrogen, the main constituent of air, must freeze, even as snow is formed in an ordinary wintry atmosphere. The resulting nitrogen frost is likely to remain in a dispersed state. Dr. Vegard also assumes that it is electrically charged.

Inasmuch as the atmosphere is shallower near the poles than at the equator, the air-frost would approach the earth more closely in polar latitudes. More light disturbances would therefore occur in such regions.

The presence of nitrogen at such great altitudes as must be necessary to get temperatures as low as 350 degrees below zero is accounted for by Dr. Vegard by the repellent effect of the electrical charges which these particles are assumed by him to carry. Temperatures at the highest levels at which observations have been made, or about 12 miles, have seldom been found lower than 85 below zero, and the temperature shows no tendency to decline further beyond that point.

Dr. Vegard suggests that this outer shell of nitrogen

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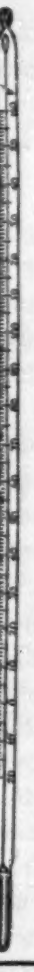

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frost-cloud may act also as an envelope for the atmosphere and prevent it from diffusing into space.

TERRESTRIAL ELECTRICITY

Science Service

THE riddle of earth currents and their annoying habit of sometimes seriously disturbing and even interrupting telegraph communication is now being studied at Alfsjo, Sweden, which is the only country in the world where the government has undertaken a thorough and systematic investigation of the subject.

The experiment station at Alfsjo has been erected by the Swedish government Department of Telegraphs, according to the plans of Dr. David Stenquist, who has made an expert study of earth currents for many years. Two lines, placed at right angles, and 1.3 kilometers and 1.8 kilometers long, respectively, are in use. Dr. Stenquist states that, while the better understanding of the phenomena of earth currents is of great interest in the science of geophysics, it is also of very great practical importance since it may lead to improvement of the telegraph service which is now often interfered with for hours at a time.

The Carnegie Institution of Washington, through its Department of Terrestrial Magnetism, also is carrying on extensive and systematic researches on earth currents at its laboratory in Washington, and installed in 1923 at its Watheroo Observatory in Western Australia two overhead lines from south to north and from west to east, each 3.2 kilometers long, and two underground lines parallel to the overhead lines each 1.6 kilometers long. In the United States very extensive work on earth currents has been done for some time by the American Telephone and Telegraph Company, and is being investigated in its department of development and research.

AN AIRSHIP GAGE

Science Service

A NEW electric gage which makes possible the recording of sudden strains thrown on the girders of the metal framework of the giant rigid airships as it battles with the storm has been developed at the U. S. Bureau of Standards by Burton McCollum and O. S. Peters, electrical engineers. Sixty of these devices have been used in tests of the "Shenandoah" and the data secured are expected to prove of great value in the design of airships in the future. Such tests were in progress when the "Shenandoah" broke away from its mooring mast during a recent storm. The instrument is also said to solve for the first time the problem of successfully measuring the effect of the impact of motor cars and trains on bridges.

With these recording machines clamped to girders in widely separate parts of the airship and connected by wire to a central station, the operator can sit in comfort and observe the stresses taking place at many points in the framework at the same time, no matter how hard they are to reach.

The gage has two blocks which are clamped to the girder or other part of the structure to be measured. A change of load on the girder causes a minute change in the distance between these blocks. These changes are transmitted to a series of carbon disks under pressure, which form a device the resistance of which varies as the pressure is changed. These resistance changes bear a definite relation to the strain in the member under test. Efforts to make a reliable strain gage on this principle have hitherto failed due to the erratic performance of the carbon plates. It is claimed that these difficulties have been overcome in the new gage.

ITEMS

Science Service

DISCOVERY that an American drug, tryparsamide, developed in the Rockefeller Institute and used in the treatment of paresis, can be substituted temporarily for the German drug used in the treatment of African sleeping sickness has been announced in London, according to a report just received by the American Medical Association. The German drug is known as Bayer 205. Immense areas of central Africa have become unfit for human habitation because of the prevalence of the sleeping sickness which is caused by a parasite carried by the tsetse fly, and Bayer 205 is claimed by its inventors to be a specific cure for the disease. It was brought out in the discussion in London that while its exact composition is unknown it is known to be a complex organic anilin substance of which the nucleus is trypan blue. Some animals and men on whom Bayer 205 was used became drug fast, or resistant to the effects of the drug. Attempts to overcome this condition have resulted in the discovery that other remedies such as antimony tartrate or tryparsamide may be substituted temporarily for Bayer 205.

EXPERIMENTS on the propagation of sound, involving the use of large quantities of high explosives, are to be carried on in May by the French government. Three gigantic explosions, each of them using about 10 tons of explosives, will be set off at amy de la Courtine in the center of France. The explosions will take place several days apart under differing atmospheric conditions. The exact time will be noted, and numerous seismographs, and other forms of registering apparatus throughout France will record the direction, intensity and character of the sound.

POOR roads as compared with good ones impose a tax of 2.5 cents a mile upon owners of Ford cars who use them, according to cost figures prepared by J. T. Madison, assistant engineer of the Kentucky highway department. The figures were based upon the performances of 36 Ford cars operating over good roads, and 26 such cars operating over poor, unimproved roads. The average cost per mile for the cars running on good roads was 4.22 cents; for those operating on the poor roads it was 6.72 cents. These figures included the cost of gasoline, oil and grease, tires and repairs, but it did not include storage and depreciation. The cost per mile for gasoline on poor roads was 2.3 cents, and on good roads 1.7 cents. Repairs cost 1.8 cents for every mile of good road travelled, while for every mile of poor road the repair bill amounted to 2.9 cents.

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If vacancies occur, students from other institutions desiring advanced standing may be admitted to the second or third year provided they fulfill our requirements and present exceptional qualifications.

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The academic year begins the Tuesday nearest October 1, and closes the second Tuesday in June. The course of instruction occupies four years and especial emphasis is laid upon practical work in the laboratories, in the wards of the Hospital and in the dispensary.

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Summer Work for Graduates in Medicine

Beginning Monday, June 2d, and ending Saturday, July 12th, a course in medical diagnosis, including laboratory exercises in clinical pathology and demonstrations in pathological anatomy, will be offered. The course will be limited to thirty students, fee $100. Applications should be made to the Dean's Office.

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As the number admitted to each class is limited, applications must be made before July 1.

Dean, Yale University School of Medicine

NEW HAVEN, CONN.

SCIENCE NEWS

ISOLATION OF A VITAMIN

Science Service

ONE of the elusive vitamins has at last been isolated. Drs. Walter H. Eddy, R. R. Williams and Ralph W. Kerr, working in the laboratories of Teachers College, Columbia Uniersity, have obtained from brewers yeast a crystalline substance, containing the elements carbon, hydrogen, nitrogen and probably oxygen, that has all the properties of vitamin D or "bios," as it is sometimes called.

This vitamin has the property of stimulating the growth of yeast. That yeast contained such a stimulant was announced in 1900, but it has never before been obtained in a chemically pure state.

Although it does not influence animal growth in the way in which vitamins A, B and C do, Dr. Eddy states that

"A special interest attaches to this isolation from our viewpoint in that the method successful with bios may be extended to the study of other vitamins. It will permit physiological studies of how a growth stimulus acts on living matter without the handicap of contaminating factors. We hasten to add with a view to discouragement of the patent medicine field, that there is at present no indication that better growth effects can be obtained with the purified material than with food extracts or foodstuffs holding it in combination."

The properties of the newly isolated substance are given as follows: "It is crystalline and the crystals melt sharply at 223 degrees Centigrade. The crystals act on polarized light and their index of refraction lies between 1.52 and 1.53. When this crystalline material is added to a yeast culture medium amounts as small as 0.005 milligrams per cubic centimeter of medium produce an increase of yeast growth of about twenty times the control in twenty-four hour incubation. It is too early as yet to construct the formulae, but we are sure that the carbon per cent. is 43, the hydrogen 8, and that the nitrogen content will run about 25 per cent. The yield by our method is about 70 milligrams from six pounds of moist brewers yeast. The process of separation has been repeated several times and with identical results. It is also found that there is a direct correlation between the activity of yeast extract residue and the amount of crystalline product removed. These results seem to indicate both that the product we have isolated is a chemical entity and that the activity of yeast growth extracts are due to this entity."

Dr. Eddy is professor of physiological chemistry in Teachers College, Columbia University. Dr. R. R. Williams is in charge of the chemical laboratories of the Western Electric Company and was in the Philippines when vitamin B was first discovered. Dr. Ralph W. Kerr is a recent graduate of Columbia.

Bios was first described by a French scientist, Wildier, in 1900. To similar substances shown to be present in various plant extracts Bottomley later gave the name of auximones. Neither of these authors actually isolated the substance, but they did show that the extracts contained something which stimulated the growth of yeast cells and other organisms.

Interest in the subject was revived in 1916 by Roger Williams who suggested that bios was actually vitamin B. It was finally discovered that while most substances rich in vitamin B do stimulate yeast growth, the stimulation may be due not to the presence of vitamin B, but to some other factor accidentally associated with it. In 1922 Casimir Funk was able to show that when an extract rich in B was shaken with Fuller's earth, the earth would remove the power of the extract to cure beri-beri, a property exclusively related to B, but did not remove the yeast growth stimulation factor. Funk interpreted his results to indicate that such extracts contained two vitamins, one the antineuritic factor for which he proposed to retain the name B and the yeast growth factor which he called vitamin D.

This suggestion of Funk's originated a controversy in which various investigators have taken part. They attempted to show that the yeast growth factor, while highly stimulatory to yeast growth, is not essential to its growth. They would reserve the term vitamin to substances producing growth, but limit it to such as were absolutely essential to growth. Others believe the term vitamin should be restricted to such factors as are essential to mammalian nutrition. Thus the yeast growth factor has been described under the two names, bios and vitamin D.

PROTECTION OF THE CORN BELT

Science Service

THE United States Corn Belt, the world's greatest food-producing area, is threatened by the advance of a European insect army. To meet the menace of the invading corn borers at the frontier, eighty entomologists, agronomists and country farm agents from Illinois, Indiana, Ohio and the federal government will in April officer a great offensive along a wide front in northern Ohio, according to war plans outlined recently by Professor George A. Dean, of the U. S. Bureau of Entomology.

An expert will be placed in every township of the infested area and some 20,000 farms will be visited to show farmers how to check the spread of the insects by destruction of the remnants of last year's crop. Later in the season some 50,000 insect allies drafted from among the foes of the corn-borer in its native land will help also to be used in the fight.

The European corn-borer entered America very probably in broom corn shipped from Italy or Hungary. It was discovered attacking sweet corn near Boston in 1917, and since then it has been a limiting factor in the growing of sweet corn in eastern Massachusetts. Another extensive area was occupied around Schenectady, New York. The insects also gained a foothold in a wide section north of Lake Erie in Ontario, Canada. Later the territory along the American shore of the lake in New York, Ohio

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Applications for this scholarship, addressed to the Secretary of the Smithsonian Institution, should be submitted not later than June 1, 1924. The application should contain a detailed plan for the proposed study including a statement as to the faunal problems involved; the reasons why it should be undertaken; the benefits that are expected to accrue; the length of time necessary for the carrying out of the project; the estimated cost; and the scientific and physical qualifications of the applicant to undertake the project.

The scholarship will be awarded for a term of two years. If at the expiration of the term it is desired to extend the time, the incumbent shall make application a sufficient time in advance, accompanied by a statement as to the necessity for such extension.

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GEO. M. GRAY,

Curator, Woods Hole, Mass,

The annual announcement will be sent on application to The Director, Marine Biological Laboratory, Woods Hole, Mass.

and southeastern Michigan became infested. Last year a marked spread of corn borers was noted in northwestern Ohio which is the beginning of the great corn belt of America.

The strategic importance of this infestation in respect to the corn belt aroused other corn-raising states. Illinois, two hundred miles from the present front, is sending experts to Ohio to cooperate in the work, as is the yet uninvaded state of Indiana. Canadian authorities are also working with the Americans to control this dangerous enemy.

In the fall, the corn-borer, in the form of a brownish caterpillar or worm about an inch long, which has been tunneling into the plant, hibernates for the winter.

As soon as warm weather begins in April or May, the borer becomes active again and about the middle of May it cuts a small circular opening from its tunnel to the surface of the plant in order to provide an exit for the future moth. It then closes this hole with a thin partition of silk and goes back into its dugout gallery where it spins a thin cocoon. About the first week of June, the borer emerges as a moth which can cover as much as 400 yards in a non-stop flight and travel anywhere from five to ten miles. The female moth usually lays her nearly flat little eggs in clusters on the under side of a leaf. The young borer, hatched from these eggs, eats for a while on the leaves, and then starts digging itself into cornstalks, corncobs, weeds or other plants, where it completes most of its development, incidentally injuring the plant.

The corn-borer attacks all parts of the plant and while it prefers corn and sorghum there are some 200 species of plants which it is known to attack. The most successful method of getting rid of this pest has been found to be the destruction of the remnants of the crop in which the borer hibernates.

Entomologists at the United States laboratory at Hyeres, near Marseilles, France, have discovered a parasite known as *Exeristes roborator*, which may prove an effective ally in checking the further spread of the borers by preying on their young which it is able to locate through corn stalks or even burdock stalks. Fifty thousand of these insect foes of the corn-borer will be released this summer in the infested areas of Ohio and New York.

BEARDLESS BARLEYS

Science Service

NAKED barley, whose peculiar virtue is that it is easily threshed, is one of the desirable agricultural immigrants brought back by Dr. Harry V. Harlan, plant explorer of the U. S. Department of Agriculture, who has just returned from a year's journey to India, Abyssinia and Egypt. He was unsuccessful in finding any new varieties of bald or beardless barleys, but brought back a general assortment of foreign varieties of small grains and legumes.

While unwhiskered barleys are known in this country, having been introduced from India many years ago, they are not of the most suitable varieties, and Dr. Harlan hoped to find some of the variants of the species which would serve for breeding crosses. These were said to be found in Nepal in India, but Dr. Harlan learned that travel to that rather remote region was so slow and uncertain that if he tried to make the trip he would be in danger of missing the trip to Abyssinia on the way home. But while in India he found some very early varieties of barley, as well as early wheat and legumes, seeds of which he brought along.

The "naked" barley, or barley which is easily separated from the glumes which enwrap the grain, and is therefore easily threshed, was found in Abyssinia and Egypt. Varieties of emmer, also easily threshed, were found. Emmer is a small grain used in Abyssinia for both forage and bread, but in most varieties the difficulty in threshing it makes it unsuitable for bread making. It is grown to a slight extent in this country. Interesting varieties of field peas, thought to be new to this country, were also found.

The natives of Abyssinia subsist chiefly on meat and bread. Asked where they got the vitamins which other races secure from dairy products, fruits and fresh vegetables, Dr. Harlan said that they used milk to some extent, but as a rule ate their meat raw, in many cases devouring the slain animals while they were still warm, possibly by this means getting the vitamins from the fresh meat. This diet, while simplifying domestic economy, makes the Abyssinians subject to tape-worm. They use honey for sweetening and make a powerful drink from it.

Dr. Harlan was in the Punjab in India during the hot season last summer and said that for a long period the temperature never fell below 100 degrees, day or night.

THE PURIFICATION OF HELIUM

Science Service

THE first helium purification car for use by the U. S. Army Air Service has been completed under the direction of the U. S. Bureau of Mines and will soon be delivered to the Air Service. It is intended for use throughout the country where helium filled balloons need to have their helium purified and separated from impurities, such as air, which diminish its lifting power.

Helium not only diffuses out of balloons, but the air diffuses in. This affects the buoyancy of the gas to such an extent that a balloon filled with a mixture of 85 per cent. helium and 15 per cent. air is practically useless. The problem has been to get the air out without the necessity of taking the balloon to one of the large stationary purification plants.

This problem the Bureau of Mines has solved through use of the property of charcoal when kept at a low temperature to absorb practically all gases, the only exceptions being inert gases such as helium. A device for the refrigeration of helium is mounted on railway trucks and arranged so that it may be transported to the immediate neighborhood of all principal landing fields and airdromes.

When a balloon descends with the helium in it mixed with air, the car will be sent for and will take the gas

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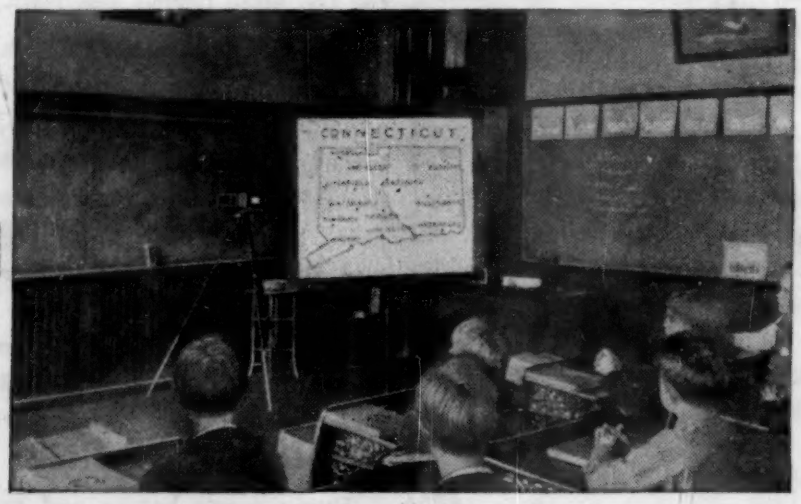

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from the balloon, purify it and compress it in metal cylinders from which it may be returned to the balloon.

The importance of the device is that it is the first successful attempt to use the absorbing property of charcoal for the purification of helium on a commercial scale. It gives helium of a high degree of purity and has a capacity of 800 to 1,000 cubic feet of gas an hour.

THE SPECTRUM IN INDUSTRY

Science Service

AMERICAN industry is making use of the spectrum as a detective, operating for its protection, it is revealed by the Bureau of Standards. Increasing numbers of industries engaged in the manufacture of metal products are finding a valuable aid in the method of spectral analysis of metals which they use, and which has been developed to its present state by the spectroscopy section of the Bureau of Standards. According to W. F. Meggers, head of this section, this system offers a more convenient and rapid means of detecting impurities in metals than chemical methods. Two big New England firms, one engaged in brass and bronze manufactures and the other in silver, are making constant use of a spectrograph, a device which makes this detection of various chemical elements a simple procedure. Other firms in Cincinnati, O., and Buffalo, N. Y., are using the same development.

Scientists of another generation, who had knowledge of the spectra of various elements, found themselves handicapped in applying a method. Except for a small group, they left the development of spectroscopy to physicists and astronomers. Through their findings in this field, the latter were able to discover helium. Increasing knowledge in the fields of electricity and photography, however, was brought to the aid of the scientists who clung to their belief that spectral analysis of materials could be perfected. And the patient persistence of this group has been rewarded.

It was while the Bureau of Standards was engaged in researches in this science that a problem came up. A steamship had been lost by a boiler explosion. In such boilers there had been placed a safety plug which was supposed to melt at certain temperatures forming one of the conditions preceding such an explosive point. The "safety plug" had apparently failed. "Why" the bureau was asked.

The spectrograph revealed that plugs which were supposed to be of pure tin contained a trace of lead, zinc and other metals in some cases. Pure tin melts at a temperature of 232 degrees, Centigrade. The presence of lead or zinc or other impurities caused the formation of a compound which required a very high temperature for melting. The reason was clear. Hence the spectrum analysis had been applied in a rapid and convenient manner, and an optical method could supplant a more complicated chemical test. The bureau then developed specifications and methods of test to eliminate further accidents from this source. In the case of a mid-western manufacturer whose factory made high pressure valves, leaks were discovered. Again the Bureau of Standards was asked "Why?". Mr. Meggars and his assistants took some of the material used and the spectrograph revealed the presence of aluminum in the alloy—in a degree unfavorable to high pressure work.

Not long ago the spectrographic method revealed its accuracy in "checking up" the Bureau of Standards itself. Standard samples of vanadium steel had been prepared and sent to various points. Word began to come back that these "standards" showed traces of tin. At once an exhaustive check-up was begun. The operations were carried on to the point of boiling down some of the chemical reagents used in preparation of the samples. A tiny scrap of residue was found, not larger than the head of a pin, too small for chemical analysis. Use of the spectrograph disclosed that there were eleven chemical elements in this tiny speck, and that the most prominent was tin.

In preparing purity standards of platinum, rhodium, iridium and palladium, the spectrograph has again been used with success, and it is declared that the chemical knowledge of these unusual metals is as yet so unsatisfactory that this method is the only safeguard.

ITEMS

OVER 50,000 fewer people died in the United States during the first nine weeks this year than last year, if figures gathered by the Bureau of the Census from cities and announced by Surgeon General Hugh S. Cumming, of the U. S. Public Health Service, indicate a nation-wide condition. The unusually low mortality rate from December 30 to March 1 is only 13.8 per thousand population per year, contrasted with nearly 16.5 per thousand for the same period last year.

THIS year has made the healthiest start on record, statistics of the Metropolitan Life Insurance Company, just announced by Dr. Louis I. Dublin, indicate. January lowered the first month record of last year and February did still better. Tuberculosis mortality dropped 13 per cent., heart disease, 22 per cent., apoplexy, 11 per cent., and Bright's disease, 14 per cent. from the February 1923 rates. Influenza killed only about one fourth as many as last year. Diabetes this January took only 17.2 per 100,000 as compared with 20.3 for January of last year and an even more pronounced decline was recorded for February.

PHOSPHORUS bombs and grenades used in practice by the army at the proving grounds at Aberdeen, Md., caused heavy mortality in an unexpected source. After the tests, large numbers of dead ducks were found in the neighboring waters of Chesapeake Bay. Examination showed that the ducks had eaten fragments of unconsumed phosphorus which had fallen in the water of their feeding grounds. Now they are using devices to frighten the birds away before the tests are made, and the bombs are being exploded either over the land or over water so deep that the ducks do not feed in it. Casualties so far are estimated at 500 and it is feared they may be much greater before all the poison is dissipated.

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If vacancies occur, students from other institutions desiring advanced standing may be admitted to the second or third year provided they fulfill our requirements and present exceptional qualifications.

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The academic year begins the Tuesday nearest October 1, and closes the second Tuesday in June. The course of instruction occupies four years and especial emphasis is laid upon practical work in the laboratories, in the wards of the Hospital and in the dispensary.

TUITION

The charge for tuition is $300 per annum, payable in three installments. There are no extra fees except for rental of microscope, certain expensive supplies, and laboratory breakage.

The annual announcement and application blanks may be obtained by addressing the

Dean of the Johns Hopkins Medical School,
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Summer Work for Graduates in Medicine

Beginning Monday, June 2d, and ending Saturday, July 12th, a course in medical diagnosis, including laboratory exercises in clinical pathology and demonstrations in pathological anatomy, will be offered. The course will be limited to thirty students, fee $100. Applications should be made to the Dean's Office.

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Dean, Yale University School of Medicine

NEW HAVEN, CONN.

SCIENCE NEWS

ICE-BERGS IN THE ATLANTIC

Science Service

ICE-BERGS are now being sighted off the bleak coast of northern Newfoundland, and the U. S. Coast Guard Service, charged with the responsibility of keeping safe the steamer lanes, has begun the annual ice patrol along the edge of the Grand Banks.

Greenland is the native home of the berg. Along those desolate shores they are born, "calved" as the sailors call it, from the great ice cap which covers nearly all of the land with a blanket of ice hundreds or even thousands of feet in thickness, and which flows slowly outwards and downwards to the sea where the dreaded bergs, the greatest menace to North Atlantic shipping, are finally set free to begin their journey of some 1,800 miles to the south.

From their birthplace to their graves in the warm waters of the Gulf Stream, the journey of the bergs is a varied one, depending on the unending conflict between the Labrador Current from the Arctic and the Gulf Stream from the tropics. It lasts a year, sometimes longer, says Lieutenant Edward H. Smith, of the Coast Guard Service, now on board the "Tampa." A third current, the East Greenland Current, setting southwest from the east coast of Greenland, also enters into the game and brings a fair contribution of bergs to mingle with the main supply from Baffin Bay.

Calved in the early summer, the bergs drift over toward the Labrador coast where they are delayed by the winter freezing of the ocean along shore. The following March finds them off the northern edge of Newfoundland, drifting southwards at a rate of about 10 to 20 miles a day. A few drift around the northern edge of Newfoundland into the Gulf of St. Lawrence, a few more drift westwards through the gully along the south coast of that island and between it and the shoal water of the Grand Banks, but most of them keep on along the eastern edge of the banks until off their southern extremity, known to sailors as the "Tail" of the banks, they finally are melted in the waters of the Gulf Stream.

It is along here that they are the greatest peril to navigation, for the tracks of the steamers from North American to North European ports all pass nearby, and it is the duty of the International Ice-Patrol, maintained by the United States, but paid for by all the principal maritime powers, to keep track of the bergs, to warn vessels and to advise when shifting of the steamer tracks to the south is necessary for safety.

While an ice-berg may be seen under the best conditions of visibility by a lookout in the crow's-nest of a liner while 15 miles away, in thick weather or fog it is a different story, Lieutenant Smith says. In dense fog a berg can not be seen further than 100 yards. Even on a clear, starlight night a lookout will not pick up a berg more than a quarter of a mile away, unless he has been warned of its existence and direction, when he may be able with binoculars to see at a distance of a mile the white streak of the seas breaking along its base. It was on such a night that the lookout of the "Titanic," off the Tail of the Banks, saw a berg just too late for the course of the vessel to be sufficiently altered. With a searchlight a berg may be seen at two miles, and in bright moonlight at five miles or even eight.

BALLOONS IN METEOROLOGY

Science Service

DR. C. L. MEISINGER, storm-riding meteorologist of the U. S. Weather Bureau, has successfully completed the first of his fifteen projected balloon journeys, undertaken to learn more about storms and how they behave. He landed late in the afternoon of April 2 at Walterboro, S. C., after a flight of 22 hours and 20 minutes from Scott Field, Ill.

The flight was terminated because of the simultaneous approach of night and of the Atlantic Ocean which is about 40 miles from Waterboro in the direction in which the balloon was travelling. Walterboro is about 40 miles west of Charleston. The air line distance from Scott Field is about 650 miles. Scott Field is at Belleville, Ill., about a dozen miles east of St. Louis, and the course of the flight was across Illinois, Kentucky, Tennessee and North and South Carolina.

The balloon was piloted by Lieutenant L. A. Lawson, of the U. S. Army Air Service, which is cooperating with the Weather Bureau in the arrangements for these flights. Most of the journey was made at an altitude of from 7,000 to 8,000 feet.

The next flight will be started as soon as the balloon can be taken back to Scott Field and re-inflated. This flight was made in the wake of the storm which brought a record April snowfall along the Atlantic Coast. Others will be started on the front, or near the centers of storms, the purpose of the flights being to study the motion across the country of the great masses of air involved in these disturbances, and to get a "close up" of the storms themselves from the air.

A NON-BOILING STEAM GENERATOR

Science Service

A NEW steam generator, revolutionizing former conceptions of steam engineering, has been given a successful trial at Rugby. It is capable of producing power from coal at an overall efficiency of something like 28 to 30 per cent. This approaches the efficiency of the Diesel oil-burning engine, which is about 35 per cent., and is in contrast to 17 to 18 per cent. efficiency for the most modern station at 350 pounds pressure and 700 degrees Fahrenheit superheat. Its efficiency rivals that of the new mercury vapor boiler recently developed in America.

The generator is the invention of M. Benson, of the Benson Engineering Company of London. Its principle is the production of steam at a pressure of 3,200 lbs. per square inch and at the "critical temperature" of water,

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GEO. M. GRAY,
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706 degrees Fahrenheit. This is by far the highest pressure ever used in steam production.

The "critical temperature" of any liquid is the temperature above which it no longer can exist as a liquid, no matter how high the pressure. Above that point the whole of the liquid changes suddenly and completely into a gas without alteration of volume. The phenomenon can be observed in a laboratory using liquid carbon dioxide, from which soda water is made, sealed in a thick glass tube and heating it slowly to 89 degrees Fahrenheit, when the whole of the liquid suddenly changes into gas. The application of this principle to water is the basis of the Benson generator, which is described by *Chemistry and Industry* here as follows:

"In the 'Benson' generator water is converted into steam at the critical temperature of 706 degrees Fahrenheit, that is, the whole mass of the water in the coils is bodily changed into steam at the same volume without the absorption of any latent heat, since the volume remains the same. It will be obvious that as no latent heat is absorbed, there is no ebullition or "boiling," that is, the sudden conversion of small particles of water into comparatively large bubbles of steam, the energy required for this increase in volume constituting the latent, or lost heat.

"It is on these highly ingenious lines that the essential trouble of the small-bore coil steam-generator has been overcome, the fact that because of the absorption of latent heat and consequent boiling the water will not remain in contact with the sides of the tube, and the generation of steam is spasmodic and apt to be explosive. The generation of steam at the critical temperature has, of course, completely eliminated this difficulty so that narrow-bore steel coils can be used which will withstand almost any pressure; in fact, the present installation is said to have been tested hydraulically to 6,400 lb. pressure."

SULPHURIZED SANDSTONE

Science Service

SANDSTONE may soon become the competitor of granite for the distinction of being one of the strongest of building materials. Tests made at the U. S. Bureau of Standards show that by the simple device of soaking sandstone for several hours in melted sulphur and then cooling it the strength of the stone is increased from 200 to 300 per cent.

The crushing strength of ordinary sandstone is about 8,000 to 9,000 pounds per square inch. But if it be subjected to the sulphur bath the crushing strength is raised to 30,000 pounds, or equal to that of the best granite.

Sandstone is porous and if it be immersed in melted sulphur, the sulphur soaks in through the pores of the rock. A treatment of several hours is sufficient to impregnate sandstone blocks of the usual building sizes and make them as strong as granite blocks. Sulphur melts at about 240 degrees Fahrenheit. Further heating thickens it, so the sandstone is immersed in the liquid while it is still cool enough to be quite fluid.

Experiments are continuing at the Bureau of Standards to determine the weathering qualities of the sulphurized sandstone, upon which its use as building material will largely depend. Investigation has also shown that sulphur also has the property of greatly increasing the strength of cement which is soaked in it, and experiments along those lines are being made.

Some of the more important public buildings of Washington, such as the White House and the Treasury, are built of sandstone, which is a favorite material for such work. Its relatively low crushing strength has, however, prevented it from being extensively used in engineering works of a massive character. The investigation so far indicates that if treated with sulphur it may be regarded as the equal of granite for these purposes so far as strength is concerned.

THE EFFECTS OF FAMINE ON THE BODY

Science Service

WHAT long-continued famine does to human beings is vividly shown in the form of a coldly scientific article on the effects of the recent famine in Russia recently published here as a translation from the work of a Russian scientist, Professor Alexis Ivanovsky, of the University of Kharkov. Not only loss of weight, but a shrinking of several inches in stature and a general drying up of the whole bodily frame similar to that experienced in advanced old age was experienced by Russians suffering from a three-year shortage of wholesome food.

When it became evident that a period of famine was approaching in Russia, and that it threatened to be of long duration, Professor Ivanovsky enlisted his colleagues in an investigation of the physical effects of starvation. The observations were made on 2,114 individuals, male and female, in all parts of Russia, and were continued for three years, each individual who survived being measured six successive times at intervals of six months.

The most universal and obvious effect of the famine was loss of weight. Not one individual was found whose weight had not diminished, while in a great number of cases the loss was as much as thirty per cent. of the normal weight. Fat was the first to be sacrificed and by the end of the famine had almost completely disappeared in all the subjects measured. After that was used up, the muscles wasted away, then some of the internal organs such as the liver or pancreas were affected, while the essential organs such as the heart and the central nervous system were little affected.

Bodily stature declined in nearly all cases, the average loss being from 1.5 to 2.6 inches in men, and from 1.4 to 1.9 inches in women. The loss was greater among young persons, but was made up by them more rapidly when food again became adequate.

The shape of the head changed. In the average famine sufferer it became relatively broader, the front and back diameter shrinking more than the transverse. The length of the face decreased less than its breadth, resulting in a typically lean, narrow visage. Similarly the nose became narrower and thinner.

"In very emaciated people," Professor Ivanovsky states, "the hair grew more slowly, fell out prematurely,

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and tended rapidly to become gray. The eyes became like those of old people, the skin lost its elasticity and became wrinkled, the gait became weak and uncertain, the body bent. The sexual instinct became very weak or even disappeared entirely. The number of births decreased enormously, while the number of children born prematurely or still-born increased, as did those born with various deformities."

Because of the irregular diet of indigestible food, ulcer of the stomach became a common complaint. The body largely lost its power of resistance, simple boils easily became carbuncles, and abscesses of the hands were common as the result of ordinary infections. Finally, Professor Ivanovsky considers the psychological factors of depression and apathy to have been of great influence, even to the extent of causing changes in the body structure.

ARTIFICIAL CELL CULTURE AND CANCER

Science Service

By growing cells outside the body for many years in his research laboratories at Washington University School of Medicine and the Bernard Free Skin and Cancer Hospital, St. Louis, Mo., Dr. Montrose T. Burrows is gaining new light on the cancer problem. His apparatus makes it possible to keep cells alive, active or growing for an indefinite number of years, and it was devised as a means of finding out why some cells continue their normal existence and why others suddenly change their nature and grow, forming cancers.

He has found that cells normally form a substance which, if present in sufficient amounts, will cause them to grow or migrate. If the circulation is too fast, this substance is removed before the cells have undergone its effect; but if the circulation is slowed up, growth or migration occurs. This explains why a well-exercised muscle gets hard and larger, because the contractions of the muscle cause momentary interference with the circulating blood and retains the substance long enough to cause the muscle to grow in size.

Louis H. Jorstad, who has been assisting in this work, found that coal tar has the power to attract cells away from their normal blood supply sufficiently to cause them to grow and multiply. These cell clumps thus formed enlarge and soon are perceptible as tumors of a cancerous nature, and can be transplanted into other animals for an indefinite number of generations. It is only when there is a clump of cells so affected by impaired circulation that the growth-producing substance can act.

In the medical world old age is noted for its defective circulation and cancers. Dr. Burrows has demonstrated that if an extract of a cancerous tumor is injected into skin which has its circulation impeded in a manner similar to that of old age, a cancer forms. Cancers frequently occur in pigmented warts or moles when their already deficient circulation is interfered with by natural changes of old age. Their exposed location predisposes them to irritation and injury which may be sufficient stimulation to cause a rapidly spreading cancer. Medical science has been groping for the cause of cancer for hundreds of years and has been unsuccessful in adequately coping with it because the cause was unknown. Since this discovery that cancer may be produced by anything which causes a rearrangement of cells in the presence of a defective circulation, it is possible that medical science will soon find methods of administering its most effective treatment and prevention.

ITEMS

Science Service

Thomas A. Edison, "the father of the electric lighting industry," has accepted the honorary chairmanship of the National Research Council Committee on Industrial Lighting, which is now being organized to conduct an extensive investigation of the relation of illumination to industrial production and the reduction of industrial fatigue. This scientific investigation plans to increase production and decrease rejections of manufactured products, to better working conditions through the decrease of industrial fatigue and the increase of safety measures and compensation, and to conduct an educational campaign urging better lighting. In administrative charge is a general directive board with Professor Dugald C. Jackson, of the Massachusetts Institute of Technology, as chairman. Present plans contemplate a two-year program and an expenditure of approximately $50,000. Test installations will be made in large manufacturing establishments in the principal industries, including the boot and shoe, textile, printing, clothing manufacturing and other industries. The field work will be supplemented by laboratory research under controlled conditions in the illumination research laboratories at the Massachusetts Institute of Technology.

When an animal eats, its whole body is nourished by the food that is absorbed at any one point. This is far from being the case with woody plants, however, according to research at the Maryland Agricultural Experiment Station. Dr. E. C. Auchter has found that "the mineral nutrients absorbed by the roots on one side of a plant are in a large measure translocated to and used by the trunk, limbs and leaves directly above them." In the experiments on which this conclusion is based, Dr. Auchter discovered that if fertilizer was applied around only half the base of a tree, the twigs on that side only showed any benefit from it. When nitrate of soda was applied to half the roots, the leaves above these roots were shown by chemical analyses to have gained in nitrogen content. On the other side of these trees the leaves showed no increase in nitrogen content, and sometimes actually decrease.

Most of us are inclined to think that the skin is a great protection against the absorption of poisonous substances. Surgeons for example often scrub their hands with bichloride of mercury solutions and put on rubber gloves with out bothering to dry the hands. Bichloride poisoning might be acquired in this way. Other poisons are sometimes absorbed through the skin. For instance, a Philadelphia painter spilled a large quantity of wood alcohol over his clothing by accident and became blind. The doctors say the wood alcohol went through the skin into the blood and was carried to the optic nerve and so did the damage.

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Dean, Yale University School of Medicine

NEW HAVEN, CONN.

SCIENCE NEWS

THE AURORA BOREALIS

Science Service

THE shimmering glow of the aurora borealis, which has mystified scientists for many years, is now declared to be due to the action of electric radiations on crystals of solid nitrogen floating in the upper atmosphere. The statement is made by the Norwegian scientist, Professor Lars Vegard of the University of Christiana, as the result of experiments made in the cryogenic laboratory of Dr. Kamerlingh Onnes at Leyden.

Earlier theories about the aurora attributed it to electric radiations from the sun. Professor Vegard extended these theories and concluded that the aurora was due to the action of these radiations on nitrogen "snow" which he assumed to exist at an altitude of more than sixty miles above the earth.

To test the theory he froze nitrogen on to a copper plate by chilling the plate to the temperature of liquid hydrogen, much as the moisture of a warm room is frozen on to refrigeration pipes in cold-storage plants. The rest of the nitrogen was mostly exhausted, resulting in greatly reduced pressure above the deposit of solid nitrogen. These crystals were then bombarded by cathode rays.

Using potentials of from 250 to 750 volts, Vegard was able to make the nitrogen crystals emit light of a greenish color, which, when examined in the spectroscope, proved to be identical with the mysterious strong green line in the spectrum of the aurora that has always been a puzzle to investigators. Vegard also found that the crystalline nitrogen kept on emitting this greenish light several minutes after the bombardment of cathode rays had ceased.

He also explains the wonderful changes of color in the aurora, for he found that under the electric excitation the solid nitrogen partly evaporates and then begins to emit light of the reddish color so characteristic of nitrogen gas.

BIRDS ATTACKING FRESHLY SHORN SHEEP

Science Service

MYSTERIOUS and vicious attacks upon newly shorn or branded sheep in the grazing country of our northwest have at last been traced to the ubiquitous magpies which frequent the sheep ranges in great numbers. For several years the sheepmen have been puzzled by fierce attacks on sheep recently clipped or branded, the wound usually being made directly in the fresh brand mark or in some cut due to the shearing operation. S. Stillman Berry, of Redlands, California, determined to make a personal investigation of the matter and finally ran the culprits down.

It was known that in Australia the Kea parrot had been guilty of similar attacks and, as the magpies were particularly numerous in the bottom lands where the sheep were turned in for pasture after shearing, a close watch was kept and the birds caught in their nefarious work. When these occurrences were first noticed the wounds were not usually serious, but as the practice became more common the birds seemed to acquire great dexterity in inflicting deep and sometimes fatal wounds. It was found that they usually started on animals showing bad shearing cuts. They would perch on the animal's rump and peck and tear at the flesh, the sheep meanwhile standing utterly helpless. With development of the habit the birds became so bold that they would attack uninjured animals, tearing and pecking until they had opened a hole through the thin coating of wool left after the shearing and then into the body cavity in an endeavor to reach the kidneys, which for some reason appear to be particularly delectable to the birds. They were quick to learn the location of these organs in the animal's body and to recognize the ease with which they could claw and tear their way to their objective.

While Mr. Berry notes a considerable number of attacks by the magpies, they extend over a period of several years and he is inclined to believe that they are sporadic and not indicative of a general habit on the part of the bird. Should the habit develop into a general characteristic of the birds, the sheepmen will indeed be confronted by a serious problem.

BAYER 205

Science Service

THE mystery of the composition of Bayer 205, the famous and well-advertised German remedy for African sleeping sickness, is believed to have been solved by the French chemist, Fourneau, and his associates. A detailed account of their work has just been published in the *Annales de l'Institut Pasteur.*

The French scientists have composed a drug which they call "309," as absolute proof of its identity with the German drug has not yet been attained. It cures mice afflicted with the trypanosome infection that causes African sleeping sickness and which is transmitted to human beings through the bite of the tsetse fly. It appears to be superior to Bayer 205 in that only 1-160th of the fatal dose cured mice. Like the German drug, it irritates the kidneys.

The French savants were guided in their search for the elusive formula by a study of a succession of patents taken out by the Bayer Company. The compound they prepared was compared with a small amount of Bayer 205 that they had at their disposal, and the two appeared to be identical.

The name "309" is merely a nickname for this interesting drug which may be invaluable in opening for settlement areas of the African tropics now devastated by the sleeping sickness. Its full name with all decorations and titles attached is: "the urea of meta-aminobenzoyl-paramethyl-meta-aminobenzoyl-1-aminonapthalene-trisulphonate of sodium 4-6 8."

Other similar but less effective substances have been

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Courses of laboratory instruction with lectures are offered in Invertebrate Zoology, Protozoology, Embryology, Physiology and Morphology and Taxonomy of the Algae. Each course requires the full time of the student. Fee, $75.00.

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GEO. M. GRAY,

Curator, Woods Hole, Mass,

The annual announcement will be sent on application to The Director, Marine Biological Laboratory, Woods Hole, Mass.

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prepared which it is thought may be serviceable in treating the sleeping sickness of domestic animals, which require larges doses than do human beings.

CHEAPER PHOSPHATES

Science Service

A REVOLUTIONARY method for the production of phosphoric acid, which will result in the saving of millions of dollars in freight rates now paid by the farmers, has been perfected by the Bureau of Soils of the U. S. Department of Agriculture. It consists in the smelting of the phosphate rock, briquetted with silica and carbon.

The phosphorus is driven off as fumes of phosphoric anhydride which are condensed and collected. The silica combines with the calcium. The process eliminates the old method of washing and screening phosphate rock, involving the loss of sometimes half the phosphoric acid contained in the deposit; and the further treatment with sulphuric acid which dilutes the phosphate rock one half and compels the consumer to pay freight on much useless material.

The volatilization process gives, on the contrary, a highly concentrated product which can be shipped long distances in lead-lined or wooden containers. Upon reaching its destination it can be mixed with the proper carriers to increase its bulk and to reduce it to the strength required for utilization by crops.

Arrangements for development of the process on a commercial scale are being made, which will result not only in a cheaper product but also in conservation of our resources of phosphate rock.

SULPHUR, SICILY AND CIVILIZATION

Bulletin of the National Geographic Society

THE United States is the world's greatest consumer of sulphur. Scientists maintain that, in the twentieth century, a nation's consumption of sulphur is a true measure of progress in civilization. Sulphur figures in practically every important manufacturing process.

Not only does the United States consume more sulphur than any other nation; it has become since the war the outstanding producer of sulphur. Back of this rise to preeminence, is a world drama between machinery and muscle, in which the United States and Sicily played the leading rôles.

The United States, armed with steam pipes, won. Sicily, actually starving, was about to give up when the American sulphur producers made an agreement to let Sicily serve the entire Italian market and ship a certain amount to other countries. It was an echo of the industrial revolution of the eighteenth century when machines began to do men's work.

Sicily in certain localities still mines sulphur as it was mined hundreds of years ago; even as the Aztecs mined gold and silver by laboriously carrying ore up in baskets. In some places the old smelting process is in use. This consists of erecting a pile of sulphur, igniting it, and letting the sulphur's own heat melt the ore. Only sixty per cent. of the mineral is recovered by this crude process and the product is impure. Better mines have cones in which the sulphur is melted and in some cases it is taken off in a volatile form, cooled to a liquid, and then to a solid block called "zolfogreggio."

Driven by competition, Sicilians used children in the mines. Child-labor presented itself in its most horrible aspects as children of seven and eight years tugged at baskets of ore in ill-made mines. Many were permanently deformed by the burdens. Gases engendered by sulphur compounds make the mines unusually dangerous.

Sulphur is found in paying quantities in many parts of the United States, but the richest deposits were discovered in Louisiana and Texas, near the coast. Here thousands of dollars and many lives were lost in wresting sulphur from nature. Quicksand, the great enemy of miners, was always on the job until finally necessity mothered invention. Frasch, a mining engineer, had an idea which revolutionized the sulphur industry.

Over a known sulphur "dome" 4,000 feet in diameter, a derrick looking for all the world like an oil derrick, was erected and a shaft forced down 1,000 feet to the sulphur. Three pipes were put down the shaft and in one superheated water under pressure was sent to do man's work. Sulphur melts at 240 degrees Fahrenheit, so it dissolves in the water. Hot air under compression was forced down a second pipe and soon hot water with liquefied sulphur came spouting up the third pipe. The stream from a "sulphur well" is directed into bins where the water is taken off leaving the mineral generally more than 99 per cent. pure. Steam shovels load it direct to freight cars. Economies of this process excluded the competition of cheapest Sicilian labor. The United States now produces 1,800,000 tons annually, almost nine times as much as Sicily mines.

If the world had known that a nation could be judged by its sulphur, England might have realized at once the American colonies' importance. The first ore shipment ever made from the United States was sulphur. When Captain John Smith established the Jamestown settlement in 1607, the colonists spent more time hunting gold than planting crops. Ships starting back for England filled their holds with what we now call "fools gold." The "precious" yellow mineral the colonists unearthened was sulphur; they sent pyrites back to England.

CARBON MONOXIDE IN CLOSED GARAGES

THE dangerous fallacy that the atmosphere in a closed garage is safe as long as an automobile engine continues to function has been disproved by a test conducted by engineers of the Interior Department at the Pittsburgh Experiment Station of the Bureau of Mines.

An ordinary touring car of popular make, which is operated daily, was run into a brick garage having a capacity of approximately 3,000 cubic feet, a dog was placed upon the driver's seat, and the engine allowed to continue running at an idling speed, which is much slower than the average motorist would use for "warming up" purposes. The doors of the garage were closed, and after 20 minutes operation of the engine, the dog

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IN CLINICAL PRACTICE, Yeast Vitamine-Harris Tablets stimulate the appetite, causing an increase in the daily intake of normal foods.

H. J. Gerstenberger (Amer. Jr. Dis. Child., Oct., 1923) has described nine cases of Herpetic Stomatitis and Herpes Labialis, all of which were improved and cured by feeding Yeast Vitamine-Harris Tablets.

This seems to be attributable to Vitamine-B asa hormone or stimulant of metabolism.

Prepared by

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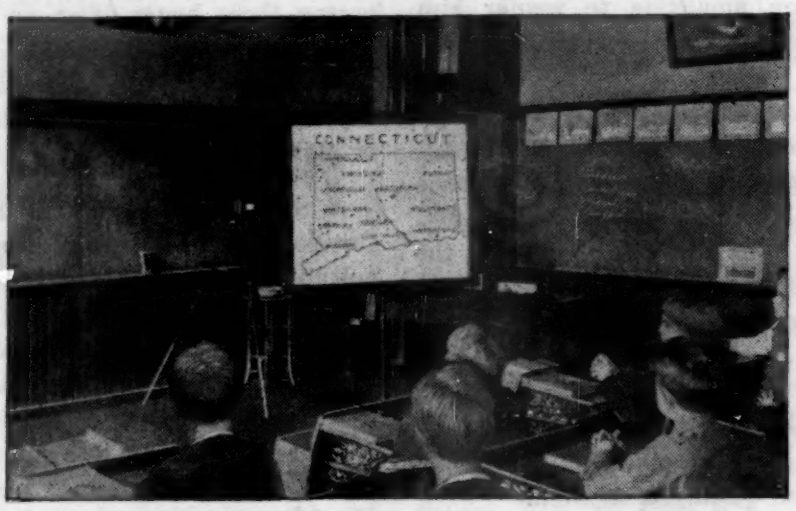

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lost consciousness and fell to the floor of the car. An analysis of the air at this time disclosed the presence of 1.3 per cent. of carbon monoxide, which is sufficient to cause unconsciousness and death in a few minutes. The automobile engine was allowed to run until it stopped from lack of air, which occurred at the end of two hours, when the percentage of carbon monoxide present in the garage atmosphere was indicated as 2.1 per cent. an almost instantaneously fatal amount.

The engine functioned six times as long as the dog retained consciousness, proving conclusively that the continued operation of an automobile engine in a closed garage is no indication as to the condition of the air and that the engine will continue to function long after the operator has lost consciousness. This experiment was conducted in a garage several times as large as the average one-car garage, and it is safe to assume that a dangerous concentration of carbon monoxide would result in a one-car garage in less than half the time recorded in this experiment. In other words, the dog would have lost consciousness in about ten minutes after the starting of the engine, which would have continued running for about one hour. The Bureau of Mines calls attention to the great danger of any one entering a closed garage for the purpose of shutting off a running engine. This frequently happens on occasions when a motorist starts his engine and leaves it running while he returns to the house for something he has forgotten. It is quite certain under such conditions that dangerous concentration of carbon monoxide will occur in a very short time if the garage is closed, and when the motorist returns he is likely to encounter an atmosphere sufficiently charged with carbon monoxide to render him unconscious in two or three minutes and to cause his death if he is not promptly rescued.

In spite of repeated warnings issued by the Bureau of Mines and other organizations interested in safeguarding human life, the newspapers continue to report deaths caused by the operation of automobile engines in closed garages. Bureau engineers wish again to emphasize the fact that carbon monoxide is given off by an automobile engine at all times and is extremely poisonous. When it is necessary to warm up the engine or to make adjustments with the engine running, all the doors and windows of the garage should be open, or better still, the car should be driven into the open air where the poisonous gases given off are quickly dissipated.

ITEMS

Science Service

RADIO authorities in Washington are not greatly impressed with the reported discovery by an English inventor of a mysterious "ray," said to be able to stop motors at a distance, blow up ammunition, or even kill men. Dr. J. H. Dellinger, chief of the radio section of the U. S. Bureau of Standards, said the story looked very much like others which had emanated from Germany and France several months ago, and which upon investigation had not been substantiated. He said he knew of no kind of radiation which could accomplish the results that have been claimed in recent reports of the invention of the English scientist. Dr. W. E. Tisdale, secretary of the physics division of the National Research Council, considered the story a probable gross exaggeration of a basis of fact. "Of course," he said, "it is possible to have radio control of motors."

A NEW photographic developer, at least equal to the world-famous "metol" of German origin, is the result of recent research by Professor Walter G. Christiansen, at the Harvard Medical School. The new chemical is a derivative of carbolic acid containing chlorine, and is closely related to metol. Numerous developing agents have been marketed during the past thirty years, but metol has come to the front on account of its speed and power of developing fine photographic detail. Metol naturally has become a standard developer throughout the world despite its high cost. While the discoverer of the new developer makes no advanced claims, there exists the possibility that the new agent may be less harmful than metol to the skin and nails of the photographer. In the commercia manufacture of metol these seems to be produced with it a poisonous by-product which makes it impossible for certain people to handle the developer solution with bare hands.

A METHOD for photographing the gall bladder has been devised by Drs. Evarts A. Graham and Warren H. Cole, of the Washington University Medical School. They have found that if a drug known as tetra-chlorphenolphthalein be injected into a vein, it appears in the gall bladder within three hours. This drug is opaque to X-rays, so that if X-ray photographs are taken of a person three hours after an injection, the gall bladder appears clearly outlined. Gall-stones can be located. Better photographs were obtained in the case of normal than with diseased organs, but this itself was of value in making a diagnosis.

A NEW plant immigrant from Korea is expected by forage crop specialists of the U. S. Department of Agriculture, to make some of the waste places of the country bloom, not like the rose, but like a field of good alfalfa. The name of the foreign grass is Korean lespedeza, and it is kin to the Japanese lespedeza, which is well domesticated on former waste land in the south. The Japanese lespedeza does not like long summer days, and consequently does not produce seed much farther north than the Ohio river, although it will grow there. The Korean variety, on the contrary, will come to seed well to the north. Like the Japanese, it thrives on poor soil and is expected to be of great economic importance.

AUTOMOBILES were found to skid less on wet pavements than on dry ones at a recent braking test participated in by several makes of cars under the auspices of the Society of Automotive Engineers and the National Bureau of Standards. The most dangerous surface was found to be one which was partially wet, especially if it were dirty and covered with a thin film of oil, but tires were found to hold on thoroughly wet and clean pavement rather better than they did on dry.

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Dean, Yale University School of Medicine

NEW HAVEN, CONN.

SCIENCE NEWS

A NATIONAL SCIENCE BUILDING IN WASHINGTON

Science Service

A NATIONAL center of science in America, an imposing building erected by the National Academy of Sciences and the National Research Council, will be dedicated here on April 28 in connection with the annual meeting of the National Academy of Sciences.

The building will be of general public interest for two reasons; first, on account of its artistic design and the beauty of its sculptures and paintings, and, second, because there will be a continuous series of exhibits illustrating striking natural phenomena and the recent discoveries of science. The new scientific building occupies a prominent site overlooking Potomac Park and adjoining the beautiful Lincoln Memorial. The cost of the building was about one and one half million dollars, besides the grounds, which were purchased by gifts from private donors. On March 28, 1919, the Carnegie Corporation of New York made a gift of five million dollars to the National Academy of Sciences to erect the building for the academy and the National Research Council, and to provide for the maintenance of the building and for the endowment of the National Research Council.

The exhibits, which will be established in the central rotunda under the great decorated dome and in the adjoining rooms, will be of a different sort from those ordinarily found in museums, for they will be for the most part so arranged that the visitor may himself perform the experiment or verify the discovery which they present. For instance, mirrors are so arranged above the central dome as to catch the light of the sun at all hours and throw the rays through a telescopic lens which, mounted in the zenith of the dome, projects an image of the sun about six inches in diameter upon a table in the middle of the hall. This is sufficiently large to show the spots on the sun, the announcement of which by Galileo in 1612 before the Lincei Academy at Rome created such a sensation and precipitated his persecution. Day by day, the movement of these spots across the sun's disk may be watched by visitors. A portion of the light from the solar image is resolved by a fine ruled grating into the spectrum of its component colors on which may be observed the Fraunhofer lines revealing the chemical elements in the gaseous envelope of the sun. In order to verify the existence of these elements of the sun, all the spectator has to do is to turn a switch and the bright lines of the spectrum of iron will appear side by side with the dark lines of iron in the solar spectrum.

Here, also, will be found in actual operation four of the amazing measuring instruments devised by Professor A. A. Michelson, president of the Academy of Sciences, who received the Nobel Prize for his researches in light. The visitor may himself manipulate the interferometers which made possible the measurement of the wave length of light and the diameter of such distant stars as Betelgeuze. Even though he be not an athlete, he can twist with his own hands a bar of steel of more than an inch in diameter, and measure the torsion by the interferometer.

The Weather Bureau has installed a complete set of recording instruments of the latest and best types. Two seismographs will be set up and visibly record any earthquakes that may occur. The Department of Terrestrial Magnetism of the Carnegie Institution has provided instruments for determining the variations in the earth's magnetism and the electrical potential of the atmosphere.

Any tourists coming to Washington who are yet unconvinced that the earth turns around may verify its rotation for themselves by watching the swing of the Foucault pendulum suspended from the center of the dome.

One of the rooms is nearly dark and here the visitor may see for himself the collision of atoms and the tracks of the flying particles by means of a Wilson-Shimizu apparatus. In this the alpha particles driven off from the atoms of radium at a speed of 20,000 miles a second leave a trail of luminous fog by which their route may be traced.

By peeping into the spinthariscope, the visitor can count the projected particles of radium by the flashes of light produced as they strike. Here, too, he may watch the perpetual dance of microscopic particles due to the jostling of the molecules—what is known as the "Brownian Movement."

One of the most beautiful sights in the world is here shown, the formation of crystals under polarized light showing all the colors of the rainbow. Professor R. W. Wood, of Johns Hopkins, will show how the world would look to us if we had the power of seeing by the "dark light" of the ultra violet-rays.

The latest developments of radio are shown side by side with classical experiments like that of Faraday's apparatus of 100 years ago for the production of electrical current by means of a magnet, which laid the foundation for all of our utilization of electric light and power.

An arrangement has been made by which the visitor himself can control the exhaustion of a vacuum tube and watch the beautiful effects caused by the passage of the electrical discharge through the rarefied gas.

A unique and most interesting exhibit will be the demonstration of the pressure of light which was unsuspected, even by scientists, until very recently, but which is now known to be the force which drives out the minute particles of matter forming the tail of a comet, and expanding the giant stars. This is shown by a radiometer, invented by Professor Ernest F. Nichols, of the Nela Park Laboratory, Cleveland.

Dr. Charles D. Walcott, secretary of the Smithsonian Institution, will exhibit the oldest fossils that have yet been discovered in which the internal anatomy has been preserved. Some jelly-fishes, worms, trilobites, sea cucumbers and other animals that lived during Middle Cam-

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brian times and which are now preserved in rocks from the Rocky Mountains will be shown.

The famous dinosaur eggs, recently discovered by the expedition of the American Museum of Natural History in central Asia, will be exhibited by Professor Henry F. Osborn, in connection with an address which he will deliver to the academy on the results of the expedition.

In an exhibit from the Department of Agriculture, Dr. W. W. Garner will show how the growth of plants can be increased or diminished by regulating the amount and kind of light.

The infinite variations that every feature of the human body and skeleton can undergo, both racially and individually, will be the subject of an exhibit by Dr. Aleš Hrdlička, of the Smithsonian Institution. He will also show the most recently discovered remains of ancient man in Europe.

Very sensitive devices for measuring the heat of the sun and stars will give the visitor an idea of the scientific work being conducted by Dr. C. G. Abbot, assistant secretary of the Smithsonian Institution, who is keeping track of these great heavenly power plants. Both the radiometer to be used this summer at Mount Wilson Observatory in determining the energy spectra of the stars and the silver disc pyrheliometer used to measure the heat of the sun will be on exhibition.

One room will be arranged for showing scientific motion pictures, and microscopes will be provided for the projection of swarms of living infusoria and growing plants.

Some of the exhibitions will be permanently installed, but most of them will be changed from time to time in order to show new inventions and discoveries in various fields of science.

Important exhibits, the details of which are not yet completely determined, will be made by the Research Laboratory of the General Electric Company and the Rockefeller Institute for Medical Research.

THE COMMON ANCESTOR OF MAN AND APES

Science Service

DISCOVERY of three fossil jaws of a primitive creature that is believed to be an ancestor to both man and the apes has been made in the Siwalik Hills of India by Dr. Barnum Brown, scientist and explorer for the American Museum of Natural History. The first announcement of this important anthropological event was made on April 14, by Dr. William K. Gregory, of the American Museum of Natural History, at a meeting of the New York Academy of Sciences at which many other evidences for human evolution were reported.

This common ancestor of human beings and chimpanzees and gorillas is called Dryopithecus. The specimens secured by Dr. Brown and sent to the museum for study are remarkable in that they show three different stages of the evolution of Dryopithecus and come from three successive periods of time or "horizons" as the geologist calls them. Each of the jaws lacks some teeth, but they are sufficiently complete and well preserved to allow Dr. Gregory, the museum's expert on human and pre-human remains, to determine that Dryopithecus is a fore-runner of man as well as the apes. Former finds of skeletons of Dryopithecus in Europe and Asia left in doubt the question as to whether this creature that lived in India during Miocene times, the middle of the great age of mammals, was actually pre-human.

Dr. Gregory found that the patterns of the crown surfaces of Dryopithecus' molar teeth are strikingly similar to the way in which the minute furrows and cracks on the surface of the enamels of human and modern ape teeth are now arranged.

Toothaches suffered by human beings to-day can be blamed largely on Dryopithecus, declared Dr. Milo Hellman, who has determined that we have inherited much of our susceptibility to dental decay from this common ancestor of man and apes. Studies of dental records show that the germs of human teeth decay lodge most frequently in the cracks and furrows that correspond to and evolve from the pattern found on the molars of Dryopithecus. Modern apes have escaped from the ravages of tooth decay, because although they possess the same inviting cracks and furrows, they eat foods that do not allow decay to set in.

The fossil jaws of Dryopithecus were discovered by Dr. Brown as the result of explorations in the north of India, when the weather was so hot that collecting could be done only in the early morning.

In addition to announcing the discovery of Dryopithecus, Dr. Gregory called attention to the fact that Darwin's conclusion that man was an offshoot of the primitive ancestors of the anthropoid apes had been buried under an accumulation of details, but that a number of investigations now going on in New York had brought forward strong new evidence in support of Darwin's view.

Dr. Dudley J. Morton pointed out that many features in the foot of the adult gorilla approach conditions in the human foot. He showed how the continuation of the habit of living on the ground and using the feet in the way the gorilla now does might be expected to make it still more like man in the distant future. He concluded that the analysis of skeletons of man, monkeys and apes definitely supports Darwin's interpretation and discredits all other theories of man's origin.

Dr. J. H. McGregor summarized the multitudinous resemblances in the soft anatomy of man and anthropoid apes and concluded that the relationship was much closer than is ordinarily suspected. He referred especially to the close resemblances in the reproductive organs of the female gorilla and mankind.

Dr. Frederick Tilney exhibited the brains of a series of apes in comparison with a human brain and said his investigation showed that as we pass from the lowest primates or lemurs through monkeys to the great apes, the brain becomes more and more human until in the gorillas it is definitely more like man's than like the brains of the lowest primates. He exhibited a series of cross sections showing the development of certain centers and nerve tracts associated with the use of the hands which become larger and more complicated as the hands

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are freed from the support of the body and as the bipedal posture becomes habitual.

Professor Henry Fairfield Osborn, president of the American Museum, said his researches on fossil mammals led him to conclude that the human line had been separated from the anthropoid line for an enormous period of time, stretching back perhaps to the lower oligocene or the second period of the age of mammals. He predicted that remote ancestors of man would be found in central Asia and that they would be large brained erectly walking primates remotely related to the anthropoids.

THE VALUE OF PREDATORY ANIMALS

Science Service

WILD CATS, wolves, coyotes and mountain lions were mixed up in a verbal battle royal between scientists attending the annual meeting of the American Society of Mammalogists here. The campaign against predatory animals as undertaken by the Federal Government was attacked as tending to upset the balance of nature and defended on economic grounds by Department of Agriculture experts.

Professor H. E. Anthony, of the American Museum of Natural History, declared that the government's present campaign against predatory animals is rapidly bringing about a critical condition. So-called predatory animals, such as the mountain lion, wolf, coyote and wild cat, are doomed to extermination over large areas, if not the entire United States. These animals should not be considered entirely harmful to man's best interest. When predatory animals have been subjected to a campaign of extermination, in nearly every instance it has been necessary to undertake stringent measures to keep down the rodents and injurious small mammals which formerly were preyed upon by the predatory mammals. In other words, the natural balance is disturbed when predatory mammals are destroyed.

Professor Anthony considers that the undertaking of a systematic, well organized and persistent campaign of extermination of predatory animals by the federal government and by the various state governments and game protective associations has an injurious effect on the public attitude toward animal life in general. The public point of view toward the lion, the wolf or the coyote, becomes prejudiced and in time a number of North American mammals are classed as "pests," "vermin," or similar opprobrious epithets, and this attitude is not conducive to the best interest of conservation.

Dr. W. B. Bell, of the U. S. Biological Survey, pointed out that the usual natural forces allow both the rodents and predatory animals to multiply inordinately and cause enormous losses to farmers and stock raisers. He presented results of examinations of the stomach contents of thousands of predatory animals killed during the past five years in all parts of the country, which showed that their favorite fare is domestic animals and not injurious rodents.

Timber wolves show a diet made up chiefly of domesticated animals, including full grown cows, calves, sheep, goats, horses and swine. Mountain lions had a strong preference for beef and venison. Over a third of the items on the coyote bill-of-fare were domestic animals with sheep and goats strongly in the lead, while bobcats also made heavy inroads on both domesticated and game animals. Dr. Bell said that the average annual destruction of livestock and game amounted to at least $50 for each coyote and bobcat and $1,000 for each wolf and mountain lion.

Major E. A. Goldman, also of the survey, pointed out that the balance of nature has long since been overthrown, and that effective control of coyotes is the urgent first need. Coyotes appear actually to be extending their range, and in recent years have pushed north through British Columbia to the upper part of the Yukon Valley, where formerly they did not occur. There is also evidence that they are extended eastward of their former range and further into the higher and rougher sections of the mountains.

As a nature lover, Major Goldman said, he did not like to contemplate the extermination of any species, but that as a practical conservationist he was forced by the records to decide against such destructive animals as mountain lions, wolves and coyotes. In his opinion these animals no longer have any place in our advancing civilization, and to advocate their protection may defeat measures vital to the future welfare of the country.

ITEMS

Science Service

FATALITIES from botulinus poisoning resulting from eating home-canned foods, such as recently occurred in a Pacific coast state, may be prevented beyond reasonable doubt by two simple precautions, according to officials of the Public Health Service. These precautions are, first, the rejection of all canned goods which on opening look or smell spoiled or tainted in the least degree; and second, the reheating to the boiling point of all canned goods before serving. It is not safe to test doubtful cans by tasting their contents before heating, as fatal cases of poisoning have occurred from this practice. The heating should be thorough, all parts of the contents of the can being brought to the boiling point. Unless one wants to risk the lives of the fowls, apparently spoiled goods should not be fed to the chickens, since there are many cases on record where whole flocks have been killed in this way. While, according to the Public Health Service, botulinus poisoning is a rare disease in proportion to the millions of cans of food packed, it is highly dangerous to eat any such food which appears to be in the slightest degree spoiled. Botulism is very rare east of the Pacific coast states in which outbreaks are much more frequent, the bacteria being apparently more common in the soil of that region. Acid vegetables and fruits which are thoroughly cooked before canning are safest. The greater number of fatalities have occurred from eating canned string beans, spinach or corn; and more deaths have resulted from eating home canned products than those which are commercially packed.

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SCIENCE NEWS

THE ZODIACAL LIGHT

Science Service

THIS is the time of year to be on the lookout for the zodiacal light which is a faint, luminous wedge of light extending from the northwestern horizon up along the zodiac, that belt of the heavens, which includes the ecliptic, or path of the sun, and also the paths of the moon and planets. It is at this time of year, in the evening, that the ecliptic rises most sharply from the western horizon and objects lying in this portion of its path can then be seen to the best advantage in the northern hemisphere.

The zodiacal light can not be seen in bright moonlight and even the brilliancy of the magnificent Venus now lying in its path may interfere somewhat with its visibility. It should be looked for shortly after sunset on a clear evening when the moon is absent. Starting near the horizon in the northwest with the constellation of Taurus, where we shall now find Venus to the east of the Hyades and ruddy Aldebaran, follow the course of the ecliptic in a southeasterly direction through Gemini with its twin stars Castor and Pollux, onward through the inconspicuous constellation of Cancer, The Crab, to the Sickle in Leo and the first-magnitude star Regulus now a little to the east of the meridian. We shall scarcely be able to trace the zodiacal light as far as this in our latitudes, even under excellent seeing conditions.

At its base, where it rests on the horizon, the zodiacal light is between twenty and thirty degrees wide, which is about the extent of the Big Dipper. From here it tapers gradually to a width of three or four degrees near the meridian. Under very favorable conditions, particularly in the tropics where the ecliptic runs up high toward the zenith, the zodiacal light has been traced as a very faint band entirely across the heavens. In its brighter portions it is a little more luminous than the Milky Way, but it gradually fades away into the dark sky. Exactly opposite to the sun there is a widening of this zodiacal band to form an oval patch ten or twenty degrees long and half as wide which is known as the *Gegenschein*, or counter-glow. This is so excessively faint, however, that very few have ever seen it in our latitudes. First discovered by Brorsen in 1854, it has been seen by a few keen-eyed observers, including the late Professor E. E. Barnard.

The zodiacal light is caused by the reflection of sunlight from numberless small particles of matter circling around the sun in the ecliptic, or plane of the earth's orbit, and chiefly between the orbit of the earth and the sun, though also to some extent beyond it. These particles may be mere meteoric dust. There is evidence that there is a large quantity of this dust in the solar system, left over possibly after the larger members of the solar system had been fashioned from the primitive solar nebula. More than likely, though, these particles are true star-dust that is continually being expelled from the surface of the sun itself under the action of light or radiation pressure, similar to the particles of which the solar corona consists.

The *Gegenschein*, or counter-glow, is believed to be due to light reflected from clouds of such particles lying at a distance of nearly one million miles from the earth and beyond the apex of its shadow where there is a tendency for matter to circulate in a sort of whirlpool under the action of the rival attractions of earth the sun, which are nearly equal at this distance. Though it is very unlikely that any one in our latitudes will be able to discover this counter-glow, there may be a number of persons who will be successful in their efforts to make out the faint, hazy glow of the zodiacal light.—*Isabel M. Lewis.*

THE RAINFALL IN NORTH DAKOTA

Science Service

A DEFINITE forecast of normal or more than normal rainfall in the state of North Dakota this spring and during the springs of the succeeding four years, was made by F. G. Tingley, meteorologist, of the U. S. Weather Bureau, in an address before the American Meteorological Society in Washington on April 29. The forecast incidentally means a probability of more than an average yield of wheat during the same period, for it has been shown that adequate rain during April, May and June is the leading factor in the yield of wheat.

The forecast is based upon a series of observations of temperatures in Indiana during the month of March which, taken in groups of five years, have a definite relation to rainfall in North Dakota four years later. When there is an increase of temperature in Indiana there is a corresponding increase in rainfall in North Dakota. If it is cool in Indiana in March, North Dakota goes dry. Mr. Tingley states this similarity has now existed for many years and is believed to be dependable as a basis of long-range precipitation forecasts for North Dakota and probably for adjacent states. It has not yet been determined just how large a region is affected by the relationship.

In the group of five years ending with 1920, the March temperature in Indiana was higher than in the group ending with 1919. It is therefore expected that the precipitation in North Dakota in the months of April, May and June for the five-year period ending with 1924 will be greater than for the one ending with 1923. Interpreted numerically this means normal precipitation in North Dakota this year.

The relationship has more than ordinary significance on account of the fact that there is a very close connection between the amount of precipitation in North Dakota in the months named and the yield of wheat in that state. Thus a forecast of precipitation is in a measure a forecast of wheat production, acreage considered. In the present difficult agricultural situation,

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Curator, Woods Hole, Ma ss,

The annual announcement will be sent on application to The Director, Marine Biological Laboratory, Woods Hole, Mass.

when control of production is being seriously considered, long-range weather forecasting becomes increasingly important. It offers the only clue to production far enough in advance to enable the acreage to be determined.

The physical basis of the relationship, or correlation as it is known meteorologically, is thought by some to lie in the slow movement of warm and cold masses of ocean water, such as the Gulf Stream and Labrador Current, which are held to affect the development of the weather of different regions. Others incline to the theory of weather cycles, or periodicities, due to unknown influences, or possibly to solar changes of one sort or another.

A correlation similar to the one described is found in the southern hemisphere between the temperature at the South Orkneys and rainfall in Argentina between three and four years later. The South Orkneys are a group of islands lying in the cold water current flowing eastward past Cape Horn and temperature there is affected by ice conditions in the Antarctic. This correlation tends to support the ocean temperature theory.

THE ELIMINATION OF THE UNFIT BY ALCOHOL

Science Service

ALCOHOL probably eliminates the unfit, and races addicted to its use outstrip the teetotalers, declares Dr. Charles R. Stockard, professor of anatomy in the Cornell Medical School of the Cornell University Medical College, in a striking article appearing in the April issue of the *American Journal of Medical Sciences*. His conclusions are based upon experiments in his own laboratory and upon a consideration of available evidence. According to Dr. Stockard alcohol protects the race by killing off many of the weak members before birth.

These experiments were made on guinea-pigs, which were treated with the fumes of alcohol to the point of intoxication six days per week for periods as long as six years. Some of the animals lived to become more than seven years old—the longest life span recorded for a guinea-pig, so far as was known to Dr. Stockard. His conclusion is that the daily inhalation of alcohol fumes does not injure the health or activities, or materially shorten the life of the treated guinea-pigs.

Definite injurious effects were discovered, however, in the offspring and later descendants of these guinea-pigs. They were studied by mating normal mothers alternately with normal and alcoholic males, and by mating normal males alternately with normal and alcoholic females. Normal males were mated 81 times with normal females and 81 times with alcoholic. The 196 young born from the normal combination showed a mortality during the first three months of less than 23 per cent. and none of the offspring was defective. Of the 185 young sired by the same fathers with alcoholic mothers, only 56.6 per cent. lived to reach maturity. The mortality was double that of the young from normal mothers. Almost 6 per cent. of these offspring were structurally defective, while none from the normal combination showed any such defects.

The effects were still more striking in the case of normal females mated alternately with normal males and alcoholic males. The same normal mothers produced all the offspring. Out of 77 normal matings, there were 195 young and only three failures to conceive. Out of 81 matings of the same females with alcoholic males, there were 182 young, but over 12 per cent. of the matings failed to result in conception. There was a mortality of 17.4 per cent. among the offspring of the normal, with 35.1 per cent. mortality among the offspring of the alcoholic. Nine of the offspring from alcoholic fathers were defective as compared with none from the normal.

The mortality among the alcoholic progeny was twice as frequent before birth as after. This means that the alcoholic tendency kills off the weak germ cells before birth. Carrying the interpretation further, it is Dr. Stockard's belief that alcohol acts as a selective agent to bring out a group of unusually strong specimens with superior vitality.

Against the argument which might be made that alcohol would injure not only the weak cells, but also the strong cells, Dr. Stockard says that human blood will not tolerate enough alcohol to injure the strong germ cells as well as the weak. No human beings would lead such alcoholic existences as were led by the guinea-pigs on which he experimented.

He concludes: "It is highly improbable that human beings have ever injured or eliminated their normal resistance germ cells with alcohol. Alcohol probably has eliminated some of the bad. Those nations of men that have used the strongest alcohol beverages through many generations, have now, from a standpoint of performance and modern accomplishments, outstripped the other nations with less alcoholism in their history."

THE PROBLEM OF THE AMERICAN INDIAN

Science Service

SEVENTY to eighty millions of people of the two Americas are still living several centuries in the past and eking out a primitive and defective existence despite the fact that their ancestors, lords of the western hemisphere before the advent of the white man, raised great cities and established cultures of great artistic and architectural accomplishment.

Dr. Manuel Gamio, director of anthropology for the Mexican government, who has just lectured at Washington as a guest of the Carnegie Institution of Washington at a conference of anthropologists, archeologists and ethnologists, pointed out these facts and declared that one of the most urgent problems before American governments was the arousing of the latent energies and possibilities of the Indian and other indigenous inhabitants, particularly in Mexico and other Central American countries. In Mexico alone, he said, there are eight to ten millions of such people, in Guatemala one million, and in this country about 300,000.

Speaking of the descendants of Aztecs, Maya and other races in Mexico, Dr. Gamio said:

When this mass of automatons recovers the dynamics

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which it had in the past and acquires the efficiency which characterizes modern action, then it will develop and make effective use of the almost virgin resources of the country.

Through the use of anthropological methods, steps are being taken by the Mexican government to build up the material and intellectual well-being of its people. Mexico was the first government to create a department of anthropology and it has carried out extensive and successful experiments in establishing the economic independence and education of the inhabitants in the Valley of Teotihuacan, only about twenty-five miles from Mexico City. Workshops for utilizing the resources of the region and schools for developing the intelligence and art of the Indian inhabitants are now located on the site of one of the most ancient civilizations of Mexico. An extension of the practical application of anthropological studies is contemplated by the Mexican government.

Dr. Gamio pointed out that no government can be logical and efficient in its action if it does not take into account anthropological factors. On the American continent and above all in these countries, the larger percentage of whose populations is of the Indian race, the truth of this assertion has been proved by history. The abnormal way in which these countries have evolved is due to the fact that the governments have ignored anthropological problems, such, for instance, as the creation of of the mestizo type, the struggles between fusing civilizations, the substitutions of languages and the anthropogeographic conditions.

As to the United States he said that while there has been more anthropological work done than in Mexico, if one compares the bulk of the work of scientific character, nevertheless anthropology has not been applied very generally to procure social betterment. If it had been, he added, the 300,000 Indians of the territories would have been incorporated into modern civilization by a skillful and harmonious blending of both cultures.

AIR-DRIVEN BOATS AND EXPRESS TRAINS

Science Service

A NEW type of water craft drawing practically no water is being developed here for service on tropical streams in the French colonies hitherto unnavigable on account of shallowness, shifting sandbars or underwater vegetation. A boat that floats in six inches of water has also been announced from Lahore, India, where it is in daily use.

Hydroglissia is the name given to flat-bottom boats driven over the surface of the water by an aeroplane engine and propeller. In various races held at Monaco and on the Seine near Paris, the speed of express trains has been consistently equalled. The world's record is held by M. Besson, whose hydroglissia officially made 74 miles an hour. His unofficial record for a later trial is 95 miles an hour.

The hydroglissia on the Sutlej River, India, is used for communication purposes. Its flat-bottom construction enables it to pass over sand-banks only a few inches submerged. In motion it rises to the surface. The keel of the boat is divided into two halves by a step of nine inches, this being an improvement on the French designs.

When the 90 horse-power engine is started, the boat moves forward compressing the water under its bow causing the first "step" to rise to the surface. The water then swirls under the nine-inch step and another wave is caused lifting the rear. As the speed is increased, the boat rises increasingly out of the water.

It is said that a speed of 35 miles an hour has been obtained with this craft carrying seven persons. The advantage of these boats in India is that at a high speed they can pass over submerged sandbanks which have always been found most difficult to locate by navigators of Indian rivers.

Hydroglissia are being prepared for service in French Africa and Indo-China. One type already built carries 20 tons of freight. Another type with two aeroplane propellers and two motors can run steadily at 45 to 50 miles an hour with a load.

ITEMS

Science Service

NEW studies of rickets and of the convulsive disorders called tetany have shown that benefit follows the giving of calcium with thyroid extract and the use of ultra-violet light. Physicians have treated hay fever and asthma for some years by giving preparations of calcium because good results followed in many instances. In a report to the American Medical Association, Drs. F. J. Novak and A. R. Hollender, of Chicago, report the results of studies made on patients with hay fever and asthma who were treated by a combination of these modern methods. When the blood of such patients was found to be abnormally low in calcium they administered preparations of calcium combined with thyroid extract and found that the patients had the usual temporary relief. These patients were then exposed to the mercury vapor quartz light which appeared to fix permanently the calcium content of the blood. The investigations are recent and further experience will show whether or not they have practical and enduring results.

WORK has begun on the Moffat tunnel through the Continental Divide about 50 miles west of Denver. The tunnel will require nearly four years to complete and will be one of the longest in the world, its total length being 32,150 feet, or 470 feet more than six miles. It will, with its connections, shorten the distance between Denver and Salt Lake by 55 miles, and open up a large area of good agricultural land now many miles from a railroad. A feature of the construction is that intermediate headings are to be driven from a pilot tunnel or parallel heading which may subsequently be used as an aqueduct. The tunnel is being built by public funds, raised by taxation of a Tunnel Improvement District, created by law for that purpose No grade in the tunnel nor on its approaches will exceed two per cent., and the maximum elevation at the highest point will be 9,242 feet as compared with more than 11,000 feet on a neighboring railway line over the divide.

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INSTRUCTION

The academic year begins the Tuesday nearest October 1, and closes the second Tuesday in June. The course of instruction occupies four years and especial emphasis is laid upon practical work in the laboratories, in the wards of the Hospital and in the dispensary.

TUITION

The charge for tuition is $300 per annum, payable in three installments. There are no extra fees except for rental of microscope, certain expensive supplies, and laboratory breakage.

The annual announcement and application blanks may be obtained by addressing the

Dean of the Johns Hopkins Medical School,
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Summer Work for Graduates in Medicine

Beginning Monday, June 2d, and ending Saturday, July 12th, a course in medical diagnosis, including laboratory exercises in clinical pathology and demonstrations in pathological anatomy, will be offered. The course will be limited to thirty students, fee $100. Applications should be made to the Dean's Office.

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SCIENCE NEWS

QUARTZ WINDOWS AND THE SUNLIGHT

Science Service

REAL sunshine indoors is the possibility held out by Dr. Edward R. Berry, assistant director of the Thomson Research Laboratory of the General Electric Company, as the result of the perfection of a process for making fused quartz. Glass windows keep out the healing and stimulating ultra-violet rays of sunshine. Quartz, or rock crystal, lets them through; and, if windows were made of quartz, people could enjoy indoors exactly the same sunshine they would get under the open sky.

The results of Dr. Berry's researches were briefly announced at the recent meeting of the American Philosophical Society in Philadelphia, and on April 29 a party of newspaper men was taken through the research laboratory at Lynn, Mass., and shown samples of various forms of the fused quartz, which, according to the inventor, is likely to revolutionize optical industries.

Rock crystal has been known from ancient times, and that it can be fused has been known for nearly one hundred years, but Dr. Berry is the first to develop a practicable method, suitable for development into commercial applications although development in that direction has been limited so far. The trick is in the use of a special type of electric furnace for the melting of the quartz, in which the heat is furnished by the electrical resistance of a carbon cylinder, within which the graphite crucible is contained.

The raw material is rock crystal of high purity, and this is melted in the furnace under much reduced atmospheric pressure so as to remove the maximum amount of air and other impurities. The fused quartz, at a temperature of close to 2,000 degrees Centigrade, or about 3,600 degrees Fahrenheit, is then squeezed out through holes either by pressure or its own weight and formed into rods or tubes, or it is cast into blocks or other shapes desired. Blocks a foot long and several inches thick were exhibited.

Possible applications of this new product may be seen from a recital of some of its more important characteristics. First, it transmits light almost completely without shutting off either the life-giving ultra-violet or the heat-giving infra-red rays. It makes easily possible the medical use of ultra-violet light either by indoor exposure to sunshine, or by the use of mercury vapor lights in quartz bulbs. Light travels down a rod of quartz much as water down a tube. Little is reflected out of the sides. So it is possible to put a source of ultra-violet light at one end of a small glass tube or rod, and transmit it almost unimpaired to the interior of the body. Ultra-violet light has been known to be fatal to the germs which cause such diseases as pyorrhea, nasal infections, and similar morbid conditions, and the light can be turned on just where it is needed.

Fused quartz can be heated to bright red heat and then plunged into ice water without cracking or injury of any sort. This is because it expands so little with heat, only .6 of a thousandths part of its length for a rise of 1,000 degrees Centigrade. This makes it valuable for use in telescope lenses, or in the projection lenses for motion pictures where the lenses are exposed to great heat from the electric light. Quartz lenses are already being used in movie theaters.

More accurate thermometers may be made of fused quartz than of glass. Dr. Berry took a glass thermometer and a quartz one, heated them both nearly to redness and then cooled them to the temperature of ice water, with the result that the quartz instrument was still accurate while the one made of glass showed big errors.

Quartz is silicon dioxide of which a large part of the crust of the earth is composed, but, so far, it has not been found practicable to make the fused quartz from anything but rock crystal, which, however, is fairly abundant and cheap. To make the highest quality of optical quartz it is necessary to remelt the quartz under a pressure of about 600 pounds. This compresses any bubbles remaining in it so as to make them of insignificant size. This quality has not as yet been placed on a commercial basis, but as to the ultimate outcome, Dr. Berry was decidedly optimistic, saying "I believe that eventually everything now made of glass may be made from quartz."

As for the immediate future, Dr. Berry exhibited a block of fused quartz, a foot long, which will be sawed by diamond saws into window panes for use in a children's clinic in a large hospital. The ultra-violet rays of sunshine cure rickets and tuberculosis, and the quartz panes will let all the sunshine into the bodies of the children without exposing them to the chill of out of doors.

EINSTEIN'S THEORY AND THE SHIFT OF THE SOLAR SPECTRUM

Science Service

EINSTEIN'S third prediction, that the spectrum of the sun is shifted slightly toward the red end as compared with light from the earth, is not borne out by experimental evidence presented to the National Academy of Sciences at its annual session by Dr. Heber D. Curtis, director of the Alleghany Observatory, Pittsburgh.

This negation of one of the important points in the Einstein theory of relativity stirred the scientists because Dr. Charles E. St. John, of the Mount Wilson Observatory, California, at the same session presented evidence in favor of Einstein's prediction of the effect of the gravitational field of the sun upon the light emanating from it. Dr. St. John made a preliminary announcement upholding Einstein last fall.

Dr. Curtis explained that the very minute shift toward the red end of the spectrum required by the Einstein theory amounted to only about eight thousandths of an Angström unit, roughly two one-millionths of the wavelength of the light.

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GEO. M. GRAY,
Curator, Woods Hole, Mass,

The annual announcement will be sent on application to The Director, Marine Biological Laboratory, Woods Hole, Mass.

SMITHSONIAN INSTITUTION

THE WALTER RATHBONE BACON SCHOLARSHIP

The Secretary of the Smithsonian Institution has approved the rules which are to regulate the award of the Walter Rathbone Bacon Scholarship for the study of the fauna of countries other than the United States of America. The amount available is the interest on the capital invested (about $2,400 a year) the incumbent to hold the scholarship not less than two years.

Applications for this scholarship, addressed to the Secretary of the Smithsonian Institution, should be submitted not later than June 1, 1924. The application should contain a detailed plan for the proposed study including a statement as to the faunal problems involved; the reasons why it should be undertaken; the benefits that are expected to accrue; the length of time necessary for the carrying out of the project; the estimated cost; and the scientific and physical qualifications of the applicant to undertake the project.

The scholarship will be awarded for a term of two years. If at the expiration of the term it is desired to extend the time, the incumbent shall make application a sufficient time in advance, accompanied by a statement as to the necessity for such extension.

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The accuracy of the measurements made by Dr. Curtis with the cooperation of Dr. Keivin Burns, of his staff, and Dr. W. F. Meggers, of the National Bureau of Standards, is more than ten times that of this predicted shift. The apparatus used was a combination of an interferometer with a powerful grating spectrograph applied for the first time to a systematic investigation of the solar spectrum.

The measurements show shifts of the spectrum, but they are of a complex nature rather than the simple and uniform amount predicted by the relativity theory.

"Instead of all the solar lines being shifted by an equal amount to the red," Dr. Curtis said, "and instead of that amount being the quantity predicted by Einstein's theory, a very marked line-intensity factor is found. For the very faint solar lines there is little, if any, shift, and the amount of this shift increases as the wider and stronger lines are used."

For a solar line of very weak or 0 or 1 intensity the shift to the red amounted to only two ten-billionths of a millimeter, while Einstein's prediction calls for a shift of eight ten-billionths of a millimeter. In the case of very strong lines or those of 15 intensity, the shift was nearly double that predicted by Einstein, or fifteen ten-billionths of a millimeter.

"There is thus seen to be an unmistakable progression in this shift, which must be due to some factor or factors other than relativity, and it does not seem possible to reconcile these results with that theory, for the theory requires that all solar lines be shifted to the red by a certain amount, while our results show that the very weak solar lines are shifted only one quarter or less of that amount. That is, if the relativity prediction is true, we must postulate some cause to shift the very weak lines back toward the violet. Now, while various causes may shift spectrum lines to the red, there is no known case of anything shifting them to the violet, except velocity, which seems untenable in this case."

On the other hand, Dr. St. John holds that the shifting of the lines of the solar spectrum are in the main satisfactorily accounted for by the Einstein theory of relativity, and that the minor deviations from the theoretical displacement observed in the rays coming from the high and low levels of the solar atmosphere are due to the motion of the currents of the hot gas. In the outer atmosphere the cooler vapors, which are settling downward, and therefore drifting away from us, cause a shift of the lines toward the red, in addition to the Einstein effect. While in the lower levels of the sun's atmosphere, three fourths of the light is emitted by the hotter rising gases, and this motion toward the earth produces a shift toward the violet which tends to reduce the Einstein effect. Recent observations made on Mt. Wilson show that there are upward and downward convection currents of incandescent gases in the stars, like those in the sun, but a vastly greater velocity.

BALLOONS TO STUDY THE SPREAD OF INSECTS

Science Service

DR. E. P. FELT, chief entomologist of the New York Conservation Commission, announces that thousands of toy balloons will be released early in May from fifteen temporary weather stations located along a wide front extending from northern Connecticut nearly to the Canadian border in an effort to discover the secrets of the winds responsible for the westward spread of the tree-destroying gipsy moth.

The gipsy moth has proved such a destructive insect in New England and New York that the State Conservation Commission, in cooperation with the federal government, has established a barrier zone in an attempt to stop its westward spread. In spite of the fact that this pest is a winged insect, it does not occupy new territory through its power of flight. The females are unable to fly on account of the extreme weight of their bodies. The big spread comes when the young caterpillars are first hatched from the eggs. These caterpillars have long hairs growing out of their bodies. These hairs, it is thought, together with the silk which the caterpillars spin help to buoy them up in the wind which sometimes carries them from a half mile to five miles from their starting place.

Last year, to learn about the winds which caused this gradual spread of the caterpillar aeronauts, 7,000 hydrogen-filled toy balloons were sent up. Each balloon bore a numbered tag requesting the finder to return it with a record of the time and place where found. Over 400 tags were recovered by the end of the season. They were found practically throughout southern New England, a number being picked up on both the eastern and southern coasts. One balloon was found off Yarmouth Cape, Nova Scotia, a drift of about 400 miles in 18 hours. Seven covered distances of 110 to 145 miles. One drifted 65 miles at the rate of 100 miles an hour. Another remained in the air six and a quarter hours and then dropped at the point of release evidently carried back by a counter current. One season's work was thought insufficient to justify definite conclusions with such variable factors as the winds, and the investigations are to be continued this spring on a more extensive scale.

THE ARCHITECT OF THE NEW BUILDING OF THE NATIONAL ACADEMY

Science Service

THE sudden death of Bertram Grosvenor Goodhue, architect of the new building of the National Academy of Sciences and the National Research Council, four days before the acceptance and dedication of what many competent critics regard as his masterpiece, has shocked and saddened the many prominent scholars and scientists who gathered there to attend the dedication ceremonies. Mr. Goodhue made his final inspection of the building on Tuesday, April 22, expecting to return on Sunday for the dedication on Monday, the twenty-eighth. He died suddenly at his home in New York the night of April 23.

Mr. Goodhue would have been fifty-five years old on the day of the dedication of the new building. He was born in Connecticut and was a member of prominent architectural firms in Boston from 1891 until 1914 when he moved to New York and began the practice of his profession in his own name.

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Ore-Dressing Microscope
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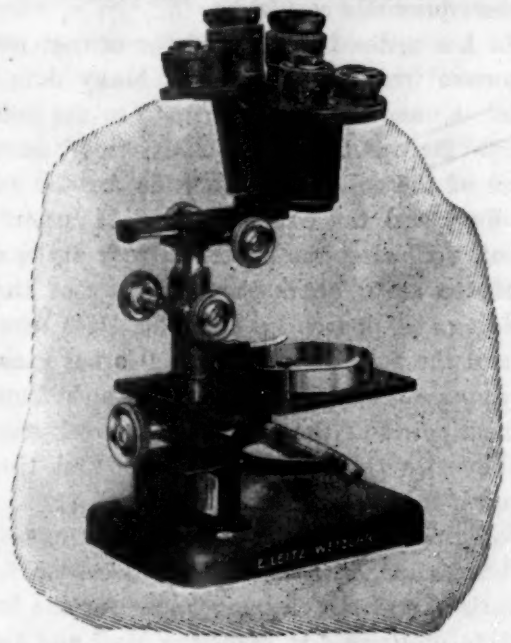

This microscope is most useful inasmuch as it is constructed to serve in an ideal manner for the determination and calculation of ore-dressing products. Being a microscope for binocular vision it renders a stereoscopic effect combined with an extremely large field and long working distance between specimen and objectives.

The equipment includes three pairs of oculars through which the microscope is available for magnifications of 10, 15 and 20x. The oculars are mounted to a rotating disc and afford an immediate interchange from one magnification to another. For measuring and counting of grains six grid-micrometers, ruled in squares of 1.0, 0.60, 0.50, 0.25, 0.10 and 0.075 mm., corresponding to the sieves used in sifting the material, are furnished with the instrument. These micrometers are inserted into the oculars.

A dish-shaped stage permits the fragments to be examined immersed in water; the bottom of the dish has a ruled square of 5 cm. x 5 cm., this being subdivided into 25 smaller squares of 1 x 1 cm., thereby facilitating the counting of grains.

The microscope is equipped with three rack- and pinion-movements; one controls the forward and backward motion of the microscope tubes, another the sideward motion of the stand to the microscope stage and the third controls the focus to the specimen.

Aside from counting and controlling ore-dressing products, the microscope is available for the stereoscopic examination of coarse specimens of crude material by removing the microscope stage and placing the specimen directly upon the microscope base.

Microscope, complete, as described, in wooden cabinet with lock and key $185.00
Code word: **MESTURABA.**

Discount to Educational Institutions and Hospitals.

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Among the best known examples of his work are some of the new buildings of the U. S. Military Academy at West Point, St. Thomas's Church in New York City and the buildings of the California Institute of Technology at Pasadena, Cal. He also designed the buildings and grounds for the San Diego exposition of a few years ago.

The new building of the National Academy of Sciences and the National Research Council is regarded as one of the finest products of his art.

In it he has utilized to the full the utmost refinements of the purest Greek architecture. Many details, themselves almost unnoticeable, contribute to the notable general effect. He was, for example, extremely particular in the choice of the color of the marble for the exterior of the building, and the courses are laid, not of uniform width, but, following the ancient Greek style, of differing widths so as to break the monotony of the face of the building. Apparently straight lines are slightly curved, and the face of the building is not exactly vertical but slopes slightly inward. All these refinements are in the finest spirit of the work of the Greek masters, and are combined in this building for the first time, so far as is known, in the New World.

The building, which will stand as a memorial to the architect's genius, will be a national center for science and scientists, and the clearing house for the latest news of scientific progress. It faces the Mall and the Lincoln Memorial, the wide waters of the Potomac and the heights of Arlington beyond, as an everlasting witness of the possibility of the union of man's sense of beauty with his quest of the unknown.

A FOG-WARNING DEVICE

Science Service

F. C. HINGSBURG, assistant superintendent of the U. S. Lighthouse Service, at Baltimore, has invented a fog valve which depends for its operation on strands of human hair. The invention is now in use.

The apparatus consists of a brass case containing hygroscopic valve mechanism. Human hair, which has been treated to eliminate oil, grease and all foreign matter, is stretched over two lugs and is pulled up to the proper tension by an adjusting screw. About 400 to 500 hairs combed parallel are used, it being considered that by an increase in the number of hairs more accurate results are obtained.

The hygroscopic device controls the current to a motor which drives the striker of a 1,000-pound fog bell mounted in a skeleton tower. Under the hair element a lever arm is suspended. There are two contacts in the electrical device, one being dry and one moist.

As the humidity approaches 96 per cent. the hair stretches and the lever arm drops, engaging a trip which breaks the dry contact and makes the moist one. The current through a relay is switched on to the motor which operates the striker.

As soon as the hair dries off after the fog is lifted, the moist contact is broken and the dry contact again made, which switches off the motor through a relay.

The contact control is not limited to fog bells, but may be used for all types of electric signals including the electric siren and various kinds of electrically operated horns.

In isolated locations where power is not available, it is necessary to resort to the energy of compressed gas. For lighthouse purposes the energy of compressed carbonic acid gas is used.

The fog valve acts as an alternate to the sun valve invented by Nils Gustaf Dalen, a Swedish farm boy, who won the Nobel prize for his invention. The sun valve operates on the principle that heat expands metals. His device lights electric bulbs or gas lights at night, and extinguishes them in the morning. In it four metal rods are exposed to the sun's heat. One is covered with lampblack and connected with a valve. The sun's rays heat this rod which is connected to a valve controlling the current or the flow of gas.

ITEMS

Science Service

THE derelict schooner, *Governor Parr*, after several months of obscurity in the North Atlantic, is again causing steamship captains some anxiety. The recent shift in the steamer lanes to the southward to avoid icebergs has brought this floating wreck into their path. The *Governor Parr*, a four masted schooner, has had one of the longest drifts of any derelict in recent years. Abandoned in a partially dismasted condition on October 3, 1923, about 350 miles east-southeast of Halifax, the vessel has been reported about 14 times since and is now almost in mid-Atlantic some 600 miles east of the Grand Banks. The drift amounts so far to approximately 1,000 miles in a straight line although the actual path is highly irregular and much longer. Attempts have been made to sink the derelict or tow her into port, but being lumber-laden she is practically unsinkable and is now too waterlogged to tow. Her last position when reported was latitude 45, and longitude 35 degrees, 30 minutes, on April 12.

A PIN was dropped on a desk by Dr. Gano Dunn in the course of his address at the dedication of the new building of the National Academy of Sciences and the National Research Council in Washington. That pin-fall was perhaps the most significant and widely heard of any in all history. Without being warned to silence, every person in the high-domed, wide-winged hall plainly heard the pin as it struck the woodwork. Thousands of radio listeners, hundreds of miles away, also heard. Specially designed artificial stonewalls made the sound clear, distinct, without those hollow echoes which characterize high vaulted buildings of the past. That pin-fall sounded an engineering triumph in the long-neglected science of acoustics.

A GREAT irrigation project, involving the storage of 80,000,000,000 cubic feet of water, has been planned in Southern India. The water will be taken from the Cauvery River and distributed to 300,000 acres.

ELECTRIC currents may be induced by applying mechanical pressure to gelatinous surfaces and this "mechano-electric" effect is supposed to be of great importance in explaining many electric effects in living organisms.

Johns Hopkins University
Medical School

The Medical School is an Integral Part of the University and is in the Closest Affiliation with the Johns Hopkins Hospital.

ADMISSION

Candidates for admission must be graduates of approved colleges or scientific schools with at least two years' instruction, including laboratory work in chemistry, and one year each in physics and biology, together with evidence of a reading knowledge of French and German.

Each class is limited to 75 students, men and women being admitted on the same terms. Except in unusual circumstances, applications for admission will not be considered after July 1st.

If vacancies occur, students from other institutions desiring advanced standing may be admitted to the second or third year provided they fulfill our requirements and present exceptional qualifications.

INSTRUCTION

The academic year begins the Tuesday nearest October 1, and closes the second Tuesday in June. The course of instruction occupies four years and especial emphasis is laid upon practical work in the laboratories, in the wards of the Hospital and in the dispensary.

TUITION

The charge for tuition is $300 per annum, payable in three installments. There are no extra fees except for rental of microscope, certain expensive supplies, and laboratory breakage.

The annual announcement and application blanks may be obtained by addressing the

Dean of the Johns Hopkins Medical School, Washington and Monument Sts., Baltimore, Md.

Summer Work for Graduates in Medicine

Beginning Monday, June 2d, and ending Saturday, July 12th, a course in medical diagnosis, including laboratory exercises in clinical pathology and demonstrations in pathological anatomy, will be offered. The course will be limited to thirty students, fee $100. Applications should be made to the Dean's Office.

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Western Reserve University
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As the number admitted to each class is limited, applications must be made before July 1.

Dean, Yale University School of Medicine

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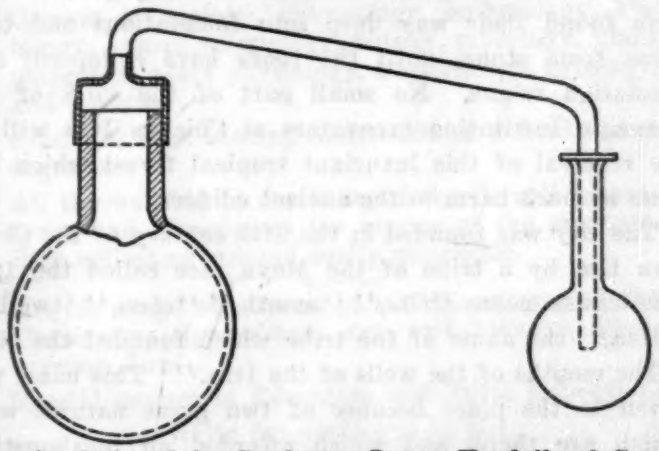

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Complete as shown $55.00

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SCIENCE NEWS

THE EXCAVATION OF MAYA CITIES

Science Service

AN archeological expedition from the Carnegie Institution of Washington, headed by Dr. Sylvanus G. Morley, is about to leave New Orleans for Mexico to begin excavations of the buried cities of the ancient Maya empire of Yucatan near the Port of Progreso.

Inauguration of a ten-year program of archeological research in cooperation with the Mexican government has been delayed by the recent political disturbances in Mexico, but arrangements were made with Dr. Manuel Gamio, director of the Mexican Bureau of Anthropology, during his recent visit to this country, to begin work immediately. The party taking the field for preliminary investigations and excavations at Chichen Itza includes Dr. Morley, Earl H. Morris, archeologist in charge of excavations, Monroe Amsden and O. G. Ricketson, Jr., assistant archeologists.

As a result of preliminary explorations at Chichen Itza made last winter, it was decided to take up first the excavation of "The Group of the Thousand Columns," a section of the city composed of great colonnaded halls surrounding a plaza of more than five acres in extent. Running out from this great colonnade there are smaller ones, composed, some of square columns and others of round ones, and at various places around the enclosure there are lofty pyramids which were originally surmounted by elaborately decorated temples of dressed stone.

The luxuriant tropical vegetation which has sprung up since Chichen Itza was abandoned in 1448 A. D. has buried the city in a mantle of living green; roots have found their way deep into foundations and torn stone from stone, until the roofs have collapsed, and desolation reigns. No small part of the work of the Carnegie Institution excavators at Chichen Itza will be the removal of this luxuriant tropical forest which has done so much harm to the ancient edifices.

The city was founded in the fifth century of the Christian Era by a tribe of the Maya race called the Itza. The names means "Chi," "mouth," "chen," "wells," "Itza," the name of the tribe which founded the city: "The mouths of the wells of the Itza." This name was given to the place because of two great natural wells which are there, and which afforded an inexhaustible water supply in a land which is conspicuous for the absence of surface or flowing water. It is not too much to say that the presence of two such wells at one place predetermined under primitive conditions that a large center of population should one day grow up around them.

One of these wells was used as a source for the water-supply of the city; the other as a place of sacrifice wherein the most beautiful maidens of the tribe were hurled in times of great drought as sacrifices to the offended rain deities. To-day the vast courts and colonnades, the lofty pyramids and spacious palaces, the temples and terraces, are silent; a great forest has overgrown them and overthrown them. It is in these remote solitudes that the ringing sound of the ax, pick and shovel of the excavator will soon be heard, and the intensive study of this former metropolis of ancient America will be commenced.

THE ISOLATION OF BIOS

Science Service

THE most dramatic moment at the recent meeting of the American Chemical Society came when Professor Walter H. Eddy, of Teachers College, Columbia, took from his pocket a small vial and passed it around among the assembled chemists. All they could see was a little white powder at the bottom of a bottle, which might have been salt or sugar so far as they could tell. Yet it created a sensation, since it was the first vitamin that any one had ever seen and handled. For many years biological chemists have been in pursuit of the elusive substances which were known to exist in certain foods and yet could not be extracted and identified because they were so small in amount, so mixed up with the complex constituents of the food, and so easily decomposed by chemical process of purification. Five or more of these vitamins have been shown to exist by the fact that when white rats are fed with foods from which some one of them is absent the animals do not thrive. They may stop growing or fall ill with various maladies or fail to reproduce.

A French chemist named Wildier in 1900 found that yeast contained a substance which in extremely small quantity would greatly increase the growth of the yeast plant. He named it "bios" but was not able to isolate it. Since then many chemists have been on its track, but none could get it out in a pure state till now, when Professor Eddy has obtained it in clean crystalline form. It is sufficiently pure to have a definite melting point, 223 degrees Centigrade, and can be analyzed. It is found to contain five atoms of carbon, eleven atoms of hydrogen, one atom of nitrogen and three atoms of oxygen in the molecules. Professor Eddy when questioned as to its chemical structure declined to commit himself positively at present but said that it might be regarded as "a reduced pyridine ring."

The same product can be extracted from alfalfa. Bios has remarkable potency as a stimulant to growth. An amount no more than three hundredths of a milligram, which is about as much of the powder as could be caught on the point of a pin, given every day to a young rat stunted by living on a deficient diet will cause it to grow again at a normal rate.

THE SEX HORMONE

Science Service

THE internal secretion that causes the sexual impulse in female animals has been discovered and extracted by Dr. Edgar Allen, of the University of Missouri, and Dr.

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July 2 to August 12, 1924

Courses of laboratory instruction with lectures are offered in Invertebrate Zoology, Protozoology, Embryology, Physiology and Morphology and Taxonomy of the Algae. Each course requires the full time of the student. Fee, $75.00.

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Animals and plants, preserved, living, and in embryonic stages. Preserved material of all types of animals and of Algae, Fungi, Liverworts and Mosses furnished for classwork, or for the museum. Living material furnished in season as ordered. Microscopic slides in Zoology, Botany, Histology, Bacteriology. Catalogues of Zoological and Botanical material and Microscopic Slides sent on application. State which is desired. For catalogues and all information regarding material, address:

GEO. M. GRAY,

Curator, Woods Hole, Mass,

The annual announcement will be sent on application to The Director, Marine Biological Laboratory, Woods Hole, Mass.

Stanford University California

Summer Quarter, 1924

Tuesday, 24 June, to Saturday, 30 August
Second half begins 28 July

Opportunities to work for the A. B. and for higher degrees, or to do special work, in the oceanic climate of the San Francisco peninsula.

Courses in the regular academic and scientific branches, and in law.

Information from Office 53,

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Philadelphia, Pa.

Edward A. Doisy, of the Washington University Medical School, St. Louis, in collaboration with B. F. Francis, H. V. Gibson, L. L. Robertson, C. E. Colgate, W. B. Kountz and C. G. Johnston.

This hormone which is obtained from the ovaries resembles the long desired "love potion" of romance and literature. Female animals treated with it take the initiative in courtship, even at an early age. Drs. Allen and Doisy believe that this extract of the contents of the ovarian follicles is the ultimate cause of sex instincts.

Young animals into which the liquid is injected become mature before they normally would. For this reason the discoverers of the ovarian hormone think that it may be responsible also for the development of the feminine characteristics which physiologists call secondary. sex characters.

Evidence has been obtained that all female animals have the same sort of ovarian hormone, just as the internal secretions from the thyroid, pancreas, adrenal and other glands are effective regardless of the animal from which they are obtained or the animal in which they are used. Extracts of the new hormone obtained from swine stimulated the sexual impulse in mice and rats. Similarly, animal extracts are being used in experiments on human beings with favorable results.

"We have high hopes for the therapeutic value of this product to medicine in the treatment of hypo-ovarian disorders," Dr. Allen declares. Subcutaneous injection of small quantities of the ovarian hormone at intervals of four to eight hours bring about reactions in rats and mice similar in all respects to the natural effects. The results of the treatment are apparent 48 hours after the first injection.

Tests made on commercial ovarian extracts now in the market show that these preparations fail to act like the new hormone. The investigators have also found that the hormone when administered by mouth does not produce the desired effects. It has no effect on the sexual functions of the male animal.

INOCULATION AGAINST CHICKEN-POX

Science Service

EXPERIMENTS made at the Johns Hopkins University by A. A. Weech indicate that chicken-pox may be prevented by inoculating persons known to have been exposed with a serum obtained from convalescent patients. He gave this treatment to nine infants who had been exposed. Only one of them contracted the disease in a mild form after a long incubation period. The work is a continuation of similar experiments of a year ago, and is similar to the method used in preventing measles.

Chicken-pox, while not a serious disease, is very contagious and spreads rapidly, especially among children in schools. Attempts have been made previously to prevent the disease by vaccinating the children with the material obtained from the little blisters which occur on the skin. The results have been of interest, and the method appears to have had considerable value in checking the disease.

Experiments made on the prevention of measles by injecting the children exposed to the disease with serum taken from the blood of those who had recently recovered gave promising results, and last year workers at the Johns Hopkins University tried the same method in chicken-pox. Out of 42 children inoculated within five days of exposure to the disease, seven contracted a mild form, and thirty escaped without symptoms.

OIL BURNING ELECTRIC ENGINES

Science Service

A CONTRACT for the construction of a new type of electric locomotive, using oil for fuel for an internal combustion engine of the Diesel type which in turn will drive the generators furnishing power to the drivers, has been signed by a large railway system with the General Electric Company and the Ingersoll-Rand Company. The new locomotive is designed for switching purposes.

The power equipment of the locomotive consists of a 300 horsepower oil engine manufactured by the Ingersoll-Rand Company, directly connected to a 200 kilowatt General Electric generator. The motive power consists of four HM-840 motors, one of which is geared to each of the four axles. The unit has a total weight of 60 tons all on the drivers.

The Ingersoll-Rand unit is a six cylinder engine designed to burn fuel oil and having the features of the well-known Price system of direct fuel injection. This system avoids the use of high-pressure injection and also effects a reduction in weight, an improvement of mechanical efficiency and an increased simplicity and reliability. The fuel is injected into the various cylinders through a distributor by means of a single acting plunger type pump. The lubricating system is of the continuous filtration type by means of which the oil is returned from a crank case through an oil filter before being returned to the system again.

All parts of the cylinders, cylinder heads and combustion chambers are water cooled by means of a thermostatically controlled water supply. The water from these water jackets passes to a radiator located on the roof and a thermostat maintains an even temperature regardless of weather conditions. Sufficient fuel can be carried for 48 hours continuous switching service. The muffler for reducing the noise of the exhaust is also mounted on the roof.

As ordinarily used in switching service, this 60-ton locomotive consumes between 20 and 26 cents worth of fuel oil per hour. The engine is free from smoke and therefore especially suitable for service in cities or other places where smoke is objectionable.

TESTING RADIO "A" BATTERIES

Science Service

TESTING radio "A" batteries with an ammeter is not a satisfactory scheme by which to determine the best brand, according to the caution of Mr. George W. Vinal, chief of the battery section of the National Bureau of Standards. Mr. Vinal explains that some of the very best and longest lived "A" batteries do not give as high an ammeter indication on this test as other brands that are very inferior in performance.

VITAMINE-B Must Be Supplied

TESTED STANDARDS

IN ALL METABOLISM STUDIES, Vitamine-B must be present in the diet, in adequate amounts, or all other elements of the experiment become a failure.

The most convenient source of a known and dependable amount of Vitamine-B is the Yeast Vitamine-B concentrate of Osborne & Wakeman (Jr. Biol. Chem., Dec., 1919).

This is used in the form of Yeast Vitamine-Harris, as powder or tablets of definite weight.

IN CLINICAL PRACTICE, Yeast Vitamine-Harris Tablets stimulate the appetite, causing an increase in the daily intake of normal foods.

H. J. Gerstenberger (Amer. Jr. Dis. Child., Oct., 1923) has described nine cases of Herpetic Stomatitis and Herpes Labialis, all of which were improved and cured by feeding Yeast Vitamine-Harris Tablets.

This seems to be attributable to Vitamine-B asa hormone or stimulant of metabolism.

Prepared by

THE HARRIS LABORATORIES

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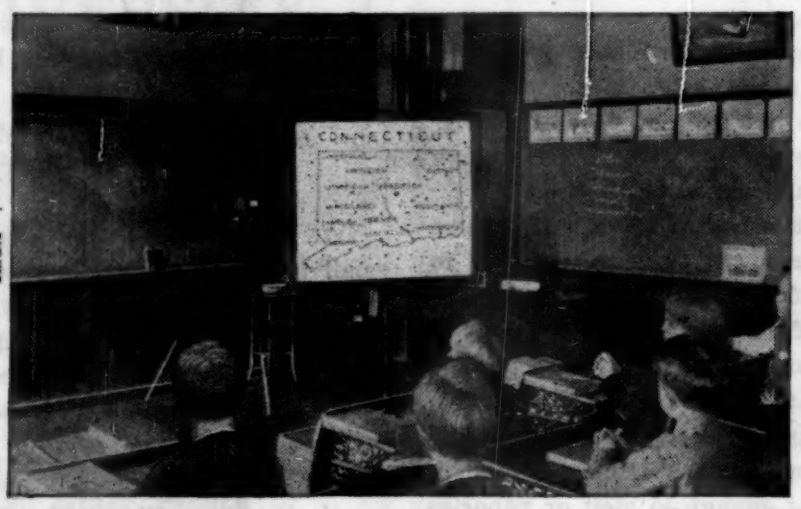

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It is all right to test a radio dry cell with an ammeter in order to determine that it has not gone dead on the dealer's shelf and a satisfactory "A" battery will give 20 to 24 amperes or more on such test if it is in good condition. But the batteries which give 30 or 35 amperes are often no better than those which give 20 or 24 amperes on this test, in fact many of them are much inferior.

Mr. Vinal explains this by pointing out the fact that the short circuit current indicated in this fashion depends as much upon the internal resistance of the battery as upon its condition. Some of the batteries which have the longest life in actual service are purposely built by a method which gives somewhat high internal resistance. And, therefore, these batteries, although the best and cheapest in the end, do not seem to have as great a "kick."

Mr. Vinal also warns against careless testing, or much short circuiting of batteries in this fashion. It takes only a short time to ruin a cell if short circuited. Hence the ammeter test should be made very quickly and every precaution taken to allow the battery to discharge only momentarily at so high a rate.

THE MELTING OF THORIUM OXIDE

Science Service

THE most refractory substance has been melted. Thorium oxide has been fused by the scientists at the U. S. Bureau of Standards. The work was done by C. O. Fairchild and M. F. Peters in the course of a research which involved the melting of platinum, and the thorium oxide was melted to enable crucibles to be made of it to hold the molten platinum.

The oxide is used commercially in incandescent gas mantles. It does not melt at the temperature attained in the gas flame, which heats it white hot. As ordinarily prepared, it is a fluffy white powder which upon heating to high temperatures gradually shrinks in volume.

But no matter how high it is heated there is still some shrinkage left. So it occurred to the investigators to take all the shrinkage out of it by melting it, something that had never been done before.

The exact details of the method have not yet been made public, beyond the fact that it was melted in a hollow formed in a heap of the powdered substance. Nothing else could be used, for it melts at a temperature only found in the electric arc, hot enough to melt or vaporize any other container. Platinum melts at a temperature of about 3,200 degrees Fahrenheit, while the melting point of thorium oxide is probably almost twice as high.

The peculiar value of crucibles made of this substance is that molten platinum may rest in them for some time without absorbing enough of the thorium oxide to be detected in a spectroscope, so permitting the metal to be purified.

A SOUTHERN NATIONAL PARK

Science Service

FURTHER progress toward the establishment of a National Park in the Southern Appalachians has been made through the selection by the Council on National Parks, Forests and Wild Life of two representatives to serve on a committee being formed by Secretary Work of the Department of the Interior. The council has chosen as its delegates Harlan P. Kelsey, formerly president of the Appalachian Club, and William C. Gregg, of the National Arts Club, known for his work in thwarting attacks by industrial interests upon Yellowstone National Park.

Secretary Work's aim in appointing the committee is to secure an impartial report on a site in the Southern Appalachians that will most worthily represent that region in the National Park system. There are already National Forests in the Southern Appalachians, acquired under the Weeks law for the protection of navigable streams. These are intended to be operated on a strictly business and economic basis, while national parks are designed solely as places where Nature's own ways of doing things are to be maintained and protected, as examples of plant and animal life undisturbed by human agencies, and where the populations of crowded cities may obtain needed contact with the wilderness.

There is a growing demand in the south for a national park, and Secretary Work has decided to refer its location to a group of men, qualified to choose one most typical of the natural beauty and wild life of the southern mountains. The chairman of the commission is Henry W. Temple, representative in Congress from Pennsylvania and formerly professor of history in Washington and Jefferson College; the Department of Interior is represented by Colonel Glenn Smith, of the U. S. Geological Survey, while the only other member aside from those selected by the Council on National Parks, Forests and Wild Life, is Major William A. Welch, whose work with the Palisades Interstate Park is well known.

ITEMS

Science Service

THE amount of power received and developed by a small loop antenna radio receiving set has been calculated by Dr. W. R. Whitney, research chemist of the General Electric Company. At the recent meeting of the American Chemical Society he said that a loop one foot in diameter, in receiving radio impulses at Schenectady from San Francisco, received such a minute amount of energy that the energy set free by a house-fly in climbing one inch up a wall would equal what was received day and night and for a continuous period of 35 years.

A SMALL mollusc, known as a Pholand, has been reported to have caused extensive injury to the brickwork at the entrance to one of the drydocks at Calcutta. The creature eats its way into the bricks where the surface glaze has been destroyed. In this particular case they were destroyed after having penetrated to about half an inch, but it is believed that except for that they would have destroyed all the brickwork.

THE electrical resistance of a wire becomes practically zero at the temperature of liquid helium. Thus a hairpin could carry all the electric power of Niagara.

Johns Hopkins University
Medical School

The Medical School is an Integral Part of the University and is in the Closest Affiliation with the Johns Hopkins Hospital.

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SCIENCE NEWS

THE TEMPERATURE OF THE OCEAN

Science Service

THE International Ice Patrol, operating from Halifax, reports that the temperature of the sea covering the 35,000 square miles of the Grand Banks of Newfoundland is 7 degrees higher than normal for the time of year. Similar conditions are found in neighboring waters, icebergs and ice-floes are almost non-existent south of Newfoundland, and wide-spread though temporary changes in the climate of eastern America and western Europe are thought likely to occur in the near future by Lieutenant Edward H. Smith, of the U. S. Coast Guard Service, who reports these phenomenal conditions.

His report is based upon the reports of the Coast Guard cutters maintaining the ice patrol. In it he says:

"The early reports from the patrol this spring are of more than passing interest due to the relatively high temperatures which are being encountered over practically the entire continental shelf south of Newfoundland. The Grand Bank, a submerged promontory of 35,000 square miles, is normally covered by a reservoir of water that is free from outside intrusions, such as ocean currents, from September to March every year. This reservoir has a mean depth of 35 fathoms, or 210 feet. It is cooled by the end of winter to a uniform temperature from surface to bottom. This water mass in March constitutes one of Nature's largest and most accurate thermometers, which registers the severity or mildness of the preceding winter season. Normally this thermometer is chilled by the cold blasts from Canada to a temperature of 30–32 degrees Fahrenheit, but this year the spring temperatures are 37–38 degrees; 7 degrees above normal. When we stop to consider that it takes approximately 3,300 times as much heat to raise a given volume of water one degree as it does a similar quantity of air, we can realize the tremendous amount of heat reserve the Grand Banks possesses this year. This also records the passage of one of the warmest winters this region has experienced in the past ten years.

"The patrol vessel has visited several fishing hamlets along the south coast of Newfoundland and all these places state that the winter of 1923–1924 was one of the mildest within the record of their oldest inhabitants. There has been very little Arctic field ice drifting south of Newfoundland this spring. The Grand Banks and offlying banks to the westward are normally covered by fields during March and April, while this year there were no fields south of Newfoundland during this period. Furthermore, during the months of April, May and June there is an average of 350 bergs totalled south of Newfoundland. This spring there have been only seven bergs and at the present writing, May 4, there is not one. We have no year like it on record."

Commenting on these observations, Lieutenant Smith says that such vast bodies of relatively warm water may be traced across the Atlantic for months and have been known to have immense effect upon the general distribution of atmospheric pressure and so upon weather conditions on both sides of the Atlantic.

"That great heat regulator, the North Atlantic," he concludes, "is passing this spring through an unusual thermal process, undoubtedly of a temporary nature. Its direct effect will most certainly be reflected in multitudinous ways and in far distant lands."

THE PLANET VENUS

Science Service

THE planet Venus, which has been such a magnificent object in the western sky during the past winter and spring, far surpassing in splendor the other planets and brightest stars, will reach her greatest brilliancy on May 24. A few weeks later she will be so close to the sun that it will be impossible to find her in the twilight haze after sunset and on July 1 she will be in inferior conjunction with the sun and pass between earth and sun. After that she will be in the morning sky and late in July the early riser will find her ready to greet him before sunrise. At the end of the first week in August, Venus will again be at her greatest brilliancy and after that will draw farther away from the sun and gradually decrease in brightness as she recedes from the earth.

About a month ago, in the latter part of April, Venus was at her greatest distance from the sun in the western sky, at greatest eastern elongation, as it is called. She was then setting more than three hours after sunset and viewed in the telescope she looked like a little half-moon. After that date she began to draw in gradually toward the sun on the side of her orbit nearest the earth and began to resemble the crescent moon in the telescope. When Venus reaches her greatest brilliancy on the twenty-fourth of this month she will look like the crescent moon at the age of five days. This crescent will gradually grow thinner until at inferior conjunction on the first of July it will disappear and the planet will be invisible even in the telescope.

It may seem strange that Venus should be at her greatest brilliancy when she shows the crescent phase instead of at eastern elongation when half her surface is illuminated and she resembles the half-moon or earlier when she looks like the gibbous moon in the telescope. It must be remembered though that Venus is much nearer to us and so appears larger when the illuminated portion is crescent-shaped. As a result this crescent is greater in area than the half moon or gibbous moon of eastern elongation and earlier which we see when the planet is farther from the earth. As the brightness of Venus is proportional to the area of the illuminated part of its surface its brightness will be greatest when the planet is in the crescent phase. But this crescent increases in size while it narrows in width as Venus draws in toward the sun and it is a nice problem in mathematics to determine just when the area of the crescent is at maximum and when as a result the brilliancy of the planet is greatest. It has been found that this always happens 36 days before and after inferior conjunction.

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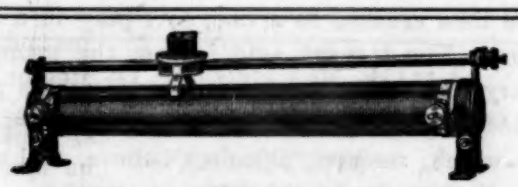

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Curator, Woods Hole, Mass,

The annual announcement will be sent on application to The Director, Marine Biological Laboratory, Woods Hole, Mass.

The Carnegie Institute of Technology

announces the establishment of four fellowships in Metallurgy under a co-operative agreement with the United States Bureau of Mines, Pittsburgh station.

The fellowships are open to graduates of universities, colleges, and technical schools whose training in physics, chemistry, or metallurgy qualifies them to undertake scientific research.

The holders of fellowships register as graduate students at the Carnegie Institute of Technology and become candidates for the degree of Master of Science.

The fellowship appointment is for a period of ten months. It carries a stipend of seven hundred and fifty dollars ($750.00).

Candidates should address

W. E. MOTT,

Director, College of Engineering, Carnegie Institute of Technology, Pittsburgh, Pa.

As Venus will be in line with earth and sun at inferior conjunction on July 1 Venus will be most brilliant on May 24 when she is visible in the west after sunset and on August 6 when she will be found in the east before sunrise. At and near the time of greatest brilliancy Venus may be easily seen in broad daylight and also like the moon she casts a strong shadow.—*Isabel M. Lewis.*

THE FOOD SUPPLY

Science Service

"THE question of food will be the dominant one to be met by the ingenuity of man in future ages," J. B. Kincer, of the U. S. Weather Bureau, predicted in an address before the American Meteorological Society. Warning his co-workers that America is the world's last food frontier and pointing out the dependence of food upon favorable climate, he discouraged beliefs that the geographic distribution of rainfall can be changed through the influence of cultivation or otherwise than by nature's own slow processes. Mr. Kincer said in part:

"Man must sustain himself from a very small portion of the earth's surface. Three fourths of it is water and of the remaining land a very large percentage is unsuited for profitable agriculture. In the western half of the United States, southern Russia, western China, and over vast areas within the tropics, limitations to intensive production are imposed by scanty moisture, while in the northern portions of the Northern Hemisphere, and in the higher elevations of middle latitudes, the limiting factors are low temperatures and the short growing season. More than one half of the land area of the globe receives less than 20 inches of precipitation annually, and only about one fourth receives those amounts which are best suited for agricultural purposes, namely, between 20 and 50 inches. Of this fourth, moreover, large areas are unsuited for cultivation, because of roughness, such as mountain sections, or because of low temperatures in more northern localities and high elevations, which leaves a very small percentage available for food production.

"Outside the temperate and tropical zones, the temperature conditions are generally unfavorable for plant growth, and of the 52,000,000 square miles of land within these zones, only about 20 per cent. is potentially arable, a little more than half of which is, at the present time, cultivated or used for pasture. The world's food supply from cultivated crops is now produced on approximately 7 per cent. of the land.

"In recent centuries, the population of the world has increased rapidly. The question of sustenance for the multiplied millions has been taken care of by migration to less densely populated countries, principally the Americas, and by importation from foreign lands of plenty. By this process the unoccupied arable land of the world has been gradually occupied until to-day very little remains in regions with healthful climates. North America now leads the world in production of many food crops, yet but yesterday, as world history goes, it supplied food for only a handful of the Red Men of the forest. To-day the United States, with only about 5 per cent. of the world's population, produces about one seventh of its cattle, one fifth of its wheat, one fourth of its oats, one third of its hogs and three fourths of its corn.

"It is true that our production, by the utilization of all available resources, such as irrigation in the West, and intensive culture in the East, comparable to that practised in the older and more densely populated countries, could be greatly increased. It has been estimated that we could feed between three and four hundred millions of people, but with the millions knocking at our door for admission, and our own natural increase in population, it is easy to vision the time, especially if we have unrestricted immigration, when this country itself would have to look elsewhere for food. The Americas are the world's last food frontier. When they shall have reached their maximum production, if populations continue to increase as in the recent past, a serious situation will be presented."

PAPER MADE FROM WOOD SHAVINGS

Science Service

DR. ALFRED TINGLE, former research chemist for one of the leading pulp and paper mills of Canada, has brought to perfection in University of Oregon laboratories a new process for producing paper pulp from wood in which shavings and similar "cull" material of the ordinary paper pulp mill may be included to give a satisfactory pulp for making a heavy grade of dark paper. All danger of overcooking smaller pieces of wood waste while larger pieces remain uncooked is avoided in Dr. Tingle's method.

Another important feature of the new process, according to Dr. Tingle, is that it can be carried on with a much simpler and less expensive plant than is needed for any other form of pulp.

The application of Dr. Tingle's digestion method, which he believes may prove applicable to northwestern fir wood and at the same time prove cheap enough in operation to use in connection with waste products, is expected to be of great importance to the lumber industry. When the new process is applied to high-grade spruce chips the product may be considered, for many purposes, a competitor with draft pulp.

Dr. Tingle's process involves a double treatment of the wood. The chips or shavings are first digested under pressure with a solution made from lime and sulphur. The product is then crushed to a fine, soft pulp in a suitable acid liquor. The "spent acid" from the manufacture of ordinary sulphite pulp may be used for this purpose. The washed pulp can then be made into a very good grade of paper which, research chemists believe, will compare well with that made from kraft.

BRICKS FROM PRESSED DIRT

Science Service Correspondence

A COMPRESSED brick made from ordinary dirt and suitable for house construction has been developed by two French engineers working under the auspices of the National Committee for Scientific Research and Invention.

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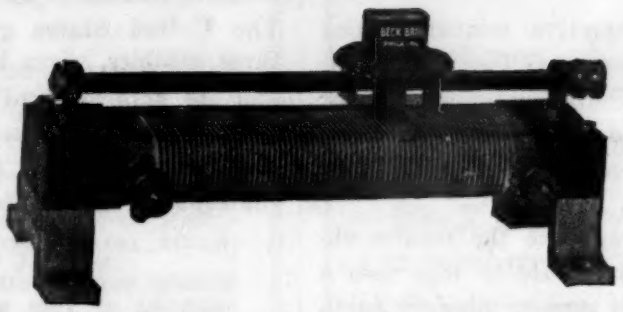

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In the process perfected by MM. Waligorsky and Carriere, ordinary subsoil earth containing five to eight per cent. of clay is compressed by tremendous pressure. The resultant bricks have a pressure resistance of 600 pounds per square inch.

Walls are coated with a protective mixture which makes them impervious to moisture. The committee states that the new bricks are only recommended for low buildings. Their chief value will be on the farm where outbuildings and walls can now be built with materials found on the premises.

The committee is trying to duplicate the results obtained by a German engineer named Hecht who uses a mixture of other ingredients. To greasy, slippery earth is added either foundry waste, coke ashes, or other cheap porus substances. Pine needles are kneaded into the mixture which is placed in moulds, compressed by hand and allowed to dry in the open air. The bricks formed are considerably larger than the ordinary variety, thus reducing the labor of brick-laying.

Two workers and an assistant working at Gross-Lichterfeld are able to make 200 to 225 bricks in an eight-hour day, equivalent to 1,300 bricks of the ordinary size.

Once they are dry these blocks are sufficiently hard to be laid the same as other bricks. A special mortar has been prepared. Laboratory tests show a resistance of 64 pounds per square inch for blocks four weeks old. Age makes them more resistant. Outside walls are made 9 to 12 inches thick, inside separating walls only 5 inches. Only one-story buildings are constructed but they are dry, warm in winter and cool in summer.

THE CHICAGO MEETING OF PHYSICIANS

Science Service

TEN thousand physicians are expected to attend the coming annual meeting of the American Medical Association which will assemble on the Municipal Pier, Chicago, from June 9 to 13. They will come from all parts of the United States and Canada and from nearly every foreign country.

The practical side of medicine in its relation to the great health problems of the day will be emphasized at this meeting although many of the 300 papers which will be presented before the 16 sections will deal with advanced theoretical problems. But such subjects as the treatment of diabetes with insulin, the treatment of heart disease, the hygiene of swimming, the treatment of gas poisoning, electric shock and lead poisoning will be among the leading topics of discussion.

In surgery, especial emphasis will be laid on progress in surgery of the nervous system and of the gall bladder, although practically every field of operation on the human body will be discussed. One paper will tell of the removal from the lungs of such substances as nails, tacks and buttons in 117 cases. The use of the new anesthetic, ethylene, and other modern anesthetics will be discussed by two sections. The problem of cancer will be treated in all its phases, from the earliest diagnosis to the treatment of advanced cases by high voltage X-rays.

The second floor of the municipal pier is being made over to accommodate the doctors and the exhibits. The exhibits will cover all the fields of medicine and surgery and will illustrate nearly every sort of diseased condition commonly met. State and national health associations will have statistical and public health displays. The United States government will be represented in three exhibits, given by the Departments of Agriculture and the Interior, and by the Public Health Service. A special motion-picture theater, in which the latest progress in medical science will be depicted, will run continuously for five days.

ITEMS

Science Service

THE first tube transmitter to be used in this country for fog-signal purposes has been put in service on the Ambrose Channel Light Vessel at the entrance of New York harbor. This transmitter was installed after a series of satisfactory tests, indicating freedom from directional distortion, lessened interference and increased efficiency. Tests for night effect showed practically no distortion due to this cause affecting the use of the signals for navigational purposes. Radio fog beacons transmit a signal which when received by a radio compass receiving set allows the operator aboard ship to locate the direction of the transmitting station. The radio compass consists essentially of a loop antenna which receives signals more effectively in one direction than in another.

THE fabled performance of the old woman of the nursery rhyme who was able to "sweep the cobwebs out of the sky" has a scientific parallel in the ability of aviators under some conditions to brush small clouds out of the sky by repeatedly flying through them. A fair sized summer cumulus of fair weather cloud may sometimes be obliterated by about 20 flights through it. While there is no adequate explanation for this effect, it is thought to be due to a combination of the stirring effect of the plane and especially of the propeller, the carrying into the cloud of warmer, unsaturated air, and the warming of the air in the cloud by the compression effect of the swiftly moving plane. The method works only when the clouds are about stationary in size, and fails when conditions are such that they are growing rapidly.

THAT fish, contrary to popular superstition, are not frightened or killed by heavy gunfire, is reported by an observer for the California Fish and Game Commission who was on the U. S. battleship *Idaho* during fleet battle practice off the California coast. The heaviest guns of the fleet were fired at intervals for hours and over a large area of the ocean, yet during the thick of the firing no fish were seen to jump from the water as frightened fish do, nor was a single dead fish found afterwards. It is explained that the vibrations of the air produced by sound above water are not transmitted to the water to any appreciable extent. Severe shocks under water, such as those due to mine explosions, kill fish, but they are apparently little affected by detonations above the surface.

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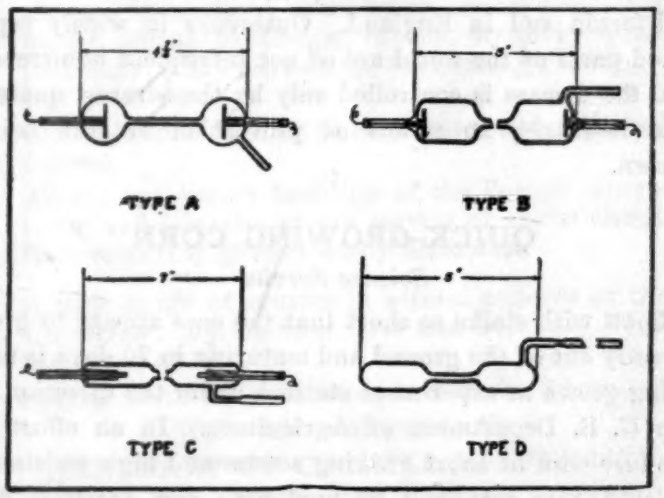

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SCIENCE NEWS

THE GERM OF "FOOT-AND-MOUTH" DISEASE

Science Service

ANNOUNCEMENT of the discovery of the germ of foot-and-mouth disease, with the forecast of the probable elaboration of a preventive serum, has been made by Dr. Heinrich Frosch and Professor Robert Dahmen, of the Berlin Veterinary Research Institute. While they have not yet made public their methods in detail, they announce that they obtained the germs from the liquid which fills the pustules which form on the feet and about the mouth of infected animals.

They propagated these germs on solid media after the usual bacteriological methods and with the thirteenth and twenty-third generations of culture were able to produce the disease in guinea-pigs. From the sixth sub-culture of another strain, a cow was inoculated and showed symptoms of the disease after eight days. Another cow, inoculated from the first one, developed a typical case.

The bacilli are too small to be seen with the highest power microscope, but by photography with light waves of short wave length they are revealed as rods about one ten thousandth of a millimeter in length, a millimeter being approximately one twenty-fifth of an inch. These tiny bacilli clot together to form globules about the size of the red corpuscles of the blood and which can easily be seen with the microscope.

The State Hygienic Institute and the Robert Koch Institute are now endeavoring to duplicate the results of Drs. Frosch and Dahmen. If they are confirmed an effort will be made to find a protective serum against this disease, which in the past few months has caused millions of dollars loss to farmers, dairymen and stock raisers in California and in England. Outbreaks in widely separated parts of the world are of not infrequent occurrence, and the disease is controlled only by the severest quarantine measures, no means of prevention or cure being known.

QUICK-GROWING CORN

Science Service

CORN with stalks so short that the ears appear to grow directly out of the ground and maturing in 70 days is now being grown at experiment stations under the direction of the U. S. Department of Agriculture. In an effort to produce corn of short growing season and high resistance to cold, this corn will be bred with new varieties discovered in the Andean highlands of South America by Fred D. Ritchey, of the Bureau of Cereal Investigations, who has just returned to Washington. This South American corn matures in a climate 20 degrees colder than that of the "corn belt."

"Corn with such short stalks is now being grown that the northern farmer may before long be harvesting his corn crop with a potato digger," said Dr. E. D. Ball, director of scientific work of the Department of Agriculture to a Science Service reporter. "Last summer I saw at the experiment station at Akron, Colorado, corn with stalks less than two feet tall when mature. The ears were so close to the ground that after hilling up they were nearly completely buried and appeared as if they were sprouting up through the ground directly from the roots. This corn matured in about 70 days."

These short-season corns are not the result of cross-breeding by department experts but are discoveries of varieties which have been grown in isolated sections in the northern parts of the continent. One of them has a rather eventful history. It was brought to Manitoba by Ruthenian immigrants a number of years ago from their native country on the slopes of the Carpathian mountains where the season is short. They have cultivated it in their colony 250 miles northwest of Winnipeg for years and have evolved a distinct variety. Others of even shorter season have been found in New Brunswick, Nova Scotia and other northern sections.

In Bolivia and Peru, Mr. Ritchey found corn maturing in spite of the fact that the average temperature for the year was 50 degrees Fahrenheit, while the average minimum temperature during the growing season was as low as 39 degrees. In our corn belt, an average night minimum of 55 degrees is considered the limit for commercial production and the average temperature during the growing season is about 72 degrees.

Few varieties of corn raised commercially in this country mature in less than 120 days, although some can be grown in 90. In the South, 150 to 180 days is the rule. It is the hope of the department through the crossing of these South American varieties with those from the far north to obtain a short-season corn, highly resistant to low temperatures. If the results are successful the product will probably be a dwarf variety, and the potato digger may come in handy when harvest time comes.

A SUPERPOWER ELECTRICAL MACHINE

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A NOVEL electrical machine which is expected to revolutionize transmission of electrical power is being exhibited for the first time at the British Empire Exposition at Wembley.

It is a "transverter," a piece of apparatus that performs the function of both transformer and rotary converter and changes ordinary low pressure alternating current into high pressure direct current.

It is expected that the realization of the vast superpower project of the United States will be hastened by this invention, since it will make easier the interconnection of various power lines and sources.

Electrical engineers have long desired to use high-voltage direct current on transmission lines in place of high-voltage alternating current which is standard to-day. The economical transmission of electrical energy over long distances requires the use of high voltages, and the higher the voltages the greater the range of economical transmission. It has not been economical, however, to

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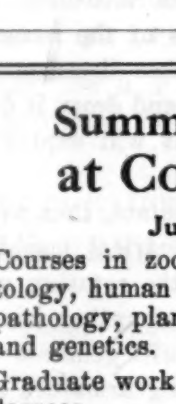

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make generators for voltages higher than 6,000 to 10,000 volts. In practice this pulsating current of relatively low voltage is put through transformers and boosted to the higher voltages, often 33,000, 66,000, 150,000, and even higher, necessary for transmission over any long distances.

But the successful operation of high-voltage alternating current transmission systems requires high technical skill. The switching off or on loads is likely to cause surges in voltage which often damage the line. Very heavy insulation is required as a result. Due to the fact that new generators feeding into a line must make their current match the current of the line exactly, in phase and frequency, the electrical characteristics of present day transmission lines must be carefully controlled. In addition the utilization apparatus must be carefully controlled to prevent excessive power loss through heating of the wires.

Direct current at high voltage is admitted to be practically ideal for transmission purposes, avoiding practically all troubles encountered in alternating current lines, but it has not been used due to the lack in the past of a device that will transform and convert a. c. into d. c., as the new transverter does.

The new transverter is the invention of W. E. Highfield and J. E. Calverey, engineers in the research laboratory of the English Electric Company. Since 1918 tests leading to the perfection of the new machine have been made secretly at the Preston plant of that company. Exhibition at Wembley of a transverter of 2,000 kilowatt output that delivers 20 amperes at 100,000 volt direct current was the first intimation of success of the research. A sister machine to the one exhibited takes direct current off the transmission line at high voltage and drops it down to low voltage alternating current that will supply industrial motors and lights.

Only the brushes on the transverter rotate, thus avoiding many of the troubles of other electrical machines. The transverter utilizes the fact that the rotating magnetic flux caused by a three-phase alternating current flowing through a stationary winding will generate current in the coils of a stationary iron ring armature completely wound with a continuous coil of wire, with ends connected. Such an armature is known as the "Gramme ring" type and such a phenomenon is the basis of every three-phase electric motor, one of the most common types used. If the brushes in contact with the armature rotate at a speed equal to the rotating flux, then the whole combination will act as a direct current dynamo, thus successfully changing alternating to direct current. In practice an ordinary transformer is substituted for the Gramme ring. By connecting several such units in series high voltage direct current is obtained.

The parts of the transformer that carry the high voltages are stationary and can be insulated and cooled by immersion in oil which is considered the most efficient method.

Distribution systems employing alternating current of different phases can be supplied off the same direct current transmission line by the use of step-down transverters of proper construction. This is expected to be especially useful when two systems join as they do in California, where the central section operates on 60 cycle and the southern section operates on 50 cycle a. c. At present the connection is made through motor-generator sets.

WIRE TRANSMISSION OF PHOTOGRAPHS

Science Service

Do not count on telegraphing a photograph of yourself to a friend in a distant city as easily as you can call him up on the long distance telephone.

Although the American Telegraph and Telephone Company has announced the successful wire transmission of photographs from Cleveland to New York, Dr. R. W. King, engineer for the telephone company, states that on account of its cost the new process will be only practicable for large scale use and will not be available for personal exchange of pictures by private individuals.

Within a year, Dr. King declared, the instruments used will be perfected for use by newspapers. The apparatus and wires may be leased as a service to newspapers, but the telephone company will operate the apparatus themselves and the pictures transmitted for at least a few years will be used for publication only.

Photographs and pictures can be transmitted only between cities connected by a superior telephone circuit, and even then high technical skill and constant supervision is necessary to keep the process in successful operation. The instruments are not yet in the commercial stage and have just been developed in the laboratory. As yet they have not been patented and only two instruments are in existence. Emphasizing the need of superior telephone circuits, engineers of the company explained that the slightest difference in the speed of the transmitting and receiving cylinders on which light writes the photograph results in a fantastic ghost portrait. Isolated points where the telephone circuits are not of the highest quality can not hope to benefit by the new telephonic transmission of pictures.

When inquiry was made as to the names of the engineers and scientists responsible for the development of the new process, it was stated that the company considered it a corporate achievement and that no names of individual engineers could ever be mentioned.

Telephone company engineers declared that the new process excels others in swiftness, accuracy and simplicity. In the method of sending photographs by wire developed by Belin, the Frenchman, the original record from which the picture is transmitted must be etched upon a brass cylinder which requires several hours to prepare. The telephone company's new process sends from ordinary photographic film and produces a similar film at the receiving end.

The principal novel features in the apparatus are declared to be as follows: A new type of light valve; the use of a direct current amplifier; an improved photoelectric cell used in the transmitter; use of carrier currents; use of electric filters to separate the carrier currents; the use of a light valve at the receiving end; the use of high-grade telephone circuits.

Demonstration of transmission of photographs by wire from Cleveland and New York by a process developed by American Telephone and Telegraph Company engineers

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FREAS

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recalls radio and wire transmission of photographs achieved by C. Francis Jenkins, a Washington inventor, nearly two years ago.

Mr. Jenkins recently exhibited photographs transmitted over the radio by his apparatus, which employs an optical means of impressing the transmitted pictures point by point upon a light sensitive cell that changes the light and shade variations into telephone or radio current modulations. Unlike the telephone company process and all others that have been announced, the Jenkins apparatus transmits from a flat picture, using a prismatic ring lens invented by Mr. Jenkins.

The Jenkins method presents the possibility of achieving radio vision since a speeding up of the transmission to the point where sixteen complete pictures are sent and received each second would be equivalent to the optical illusion of the motion picture. A wave of the hand has already been transmitted by radio in the Jenkins laboratory.

HEALTH AND CHARACTER

Science Service

HEALTH is not necessary for good nature in children, according to Dr. Karl Pearson, as the result of a study of about 2,000 boys and 2,000 girls in English schools. Neither is health nor the lack of it always or even frequently associated with vivacity, popularity or conscientiousness. There was found to be little relation between health and general intelligence.

Athletic prowess went with good health as did self-assertiveness; but the old idea that delicate children take to intellectual work and are particularly shy and conscientious was not confirmed, nor was the similar one that lively boys are likely to neglect studies for physical sports. Blonds were found to be slightly less healthy than brunettes.

Dr. Pearson's results, it is asserted, seem to shatter widely held beliefs. They indicate that it is not possible for teachers to modify general intelligence or psychic characters which seem to be unchanged throughout the whole of school life; that general health changes little during the school period; and that health is not a governing factor of temperament. Health was found to be associated to only a slight extent with qualities of character, and with temper practically not at all.

Babies depend more on their heredity for good health than upon what station of life they are born into or what care they get, concludes Professor Pearson as the result of a similar statistical study of 1,600 babies from a large manufacturing town. The poor health of those not breast-fed is stated to be chiefly due to the inheritance of the weakened constitution of a mother not able to nourish her child. Clothing is important, but it is not highly correlated with health and it becomes less important as the child grows older.

The health of the father and mother is most important, and it is stated to have more to do with the health of the child than the wages of the father or the employment of the mother.

ITEMS

Science Service

THROUGH international cooperation a regular weather bulletin covering a region in the South Pacific Ocean nearly as large as the continental United States is now being broadcast twice daily from Apia, Samoa. Messages are exchanged and relayed between islands 2,000 miles apart, and the forecast from Apia is based upon them. Special storm warnings are also broadcast when conditions warrant them.

AGRICULTURAL officials of the French government in Algeria have found a new method of preventing forest fires. It consists in carpeting the ground under the trees with a hardy creeping plant that will not burn. Juicy plants that do not dry up and that spread rapidly even in the shade are being planted. Not only are the plants incombustible but they have an additional value in conserving the moisture of the soil. Weeds are also choked by the thick, obscuring foliage. The plants used are species of ground ivy.

WHAT place in America is famous for its petroleum refining? Not Texas or California, famous for oil, but New York City and its environs. A survey by the Committee on Regional Plan of New York and its Environs shows that the out-put of refineries in the vicinity of New York represents one fifth of the petroleum wealth of the entire country. It was also found that a region containing one tenth of the population of the country is producing one fifth of the chemical output of the United States. The chemical industry is centered in New York. Yet Manhattan and Brooklyn, New York proper, is rapidly becoming an odorless city, the chemical industry is deserting that part of New York for the open country and cheaper land.

DOCTORS may now take a peep between the ribs of a patient and perform operations on the surfaces of the lungs without removing a section of a rib. An instrument which makes this possible has been invented by Dr. J. J. Singer, of the Washington University School of Medicine. It is smaller in diameter than a lead pencil, carries a small light and lenses, and may be inserted between the patient's ribs after the administration of a local anesthetic. By use of this thoracoscope, as it is called, the surgeon may see just what conditions are at the surface of the lungs and may perform small operations without further incision.

RADIO is not only being used in lighthouses and on light vessels to make more safe the way of those who navigate the dark and foggy sea, but also to make more pleasant and endurable the lonely lives of the men of the lighthouse service. An example is furnished at Cape St. Elias lighthouse on the Alaskan coast. Formerly isolated from the world, the men stationed there now listen in on Los Angeles, San Franciso, Seattle, Portland, and stations as far inland as Nebraska. They report the radio "has certainly made the station a lot more cheerful."

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The academic year begins the Tuesday nearest October 1, and closes the second Tuesday in June. The course of instruction occupies four years and especial emphasis is laid upon practical work in the laboratories, in the wards of the Hospital and in the dispensary.

TUITION

The charge for tuition is $300 per annum, payable in three installments. There are no extra fees except for rental of microscope, certain expensive supplies, and laboratory breakage.

The annual announcement and application blanks may be obtained by addressing the

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Beginning Monday, June 2d, and ending Saturday, July 12th, a course in medical diagnosis, including laboratory exercises in clinical pathology and demonstrations in pathological anatomy, will be offered. The course will be limited to thirty students, fee $100. Applications should be made to the Dean's Office.

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RESEARCH FELLOWSHIPS—Four fellowships of the value of $500 each are awarded annually to promote scholarly research.

TUITION FEES—The tuition fee for undergraduate students is $180.00 a year.

Next session begins September 26, 1924.

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As the number admitted to each class is limited, applications must be made before July 1.

Dean, Yale University School of Medicine

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SCIENCE NEWS

UNUSUAL WEATHER CONDITIONS

Science Service

UNUSUALLY warm water in the northwestern Atlantic ocean and especially over the Grand Banks of Newfoundland is considered by U. S. Weather Bureau experts as a very likely cause for one of the wettest months of May in years. The presence of this warm region in the Atlantic was discovered by U. S. Coast Guard cutters on the International Ice Patrol and was first reported by Science Service.

An abnormal number of areas of low barometric pressure, or general storms, have crossed the United States during the past few weeks. Their course has been unusually far to the south for the time of year, causing warm, moist south winds bringing rain to nearly all the country east of the Mississippi river.

The reason for the southerly track of these storms is stated by the Weather Bureau to be a big low-pressure area which has settled down over the Grand Banks for weeks. Such a distribution of the pressure of the atmosphere causes northerly winds along the northern border of the United States, bringing cool air currents which serve to push the eastward moving lows farther to the south, and which also by running under and pushing up to the cold regions of the upper atmosphere the moisture-laden winds from the south cause frequent and abundant rains.

The reason for this persistent low-air pressure over the Grand Banks is said by the Weather Bureau to be probably due to the reported warm water in that region. The Ice Patrol reported several weeks ago that the temperature of the ocean water over the whole area of the banks, a matter of thousands of square miles, was 7 degrees warmer than normal for the time of year. Warm ocean water means that the air above it is warmer. Warm air weighs less than cold, hence warm ocean water is apt to be covered by a region of low air pressure such as has actually been present near Newfoundland. The ultimate reason for the warm ocean water is unknown; nor would the Weather Bureau make any prediction as to when or how the present run of bad weather over the east would break up.

The month has been wet everywhere east of the Mississippi, but to the westward dry weather has been the rule. Cool weather has prevailed generally east of the Rocky Mountains. Planting of corn and cotton has been seriously delayed in the east, but small grains, potatoes and fruits has been generally benefited. In the western portions of the corn belt and of the wheat-growing sections, cool dry weather has retarded crop development.

SURVEYING WITH RADIO AND SOUND WAVES

Science Service

A NEW method of marine surveying using both radio and sound waves has been developed by the U. S. Coast and Geodetic Survey with the cooperation of the U. S. Bureau of Standards, and is now being used in surveys of the Oregon coast. It may be used even in a dense fog and is as accurate as any of the usual methods of sight surveys at sea.

The method depends on the velocity of sound through the sea water which, if known, enables the operator on shipboard to fix his distance from two or more known positions on shore. A simple calculation then permits him to work out his own position. In this method a bomb fired under water near a vessel sends out a sound wave which travels till it reaches an underwater telephone near and connected by cable with a shore radio station. The sound itself by means of suitable apparatus sends back a radio signal to the ship in such a way that, while there is a delay in the return of the signal, this delay can be accurately measured and the result is the same as if there were no delay whatever.

The procedure has been worked out especially for application to surveys to be made along the North Pacific Coast where weather conditions make difficult or even impossible ordinary methods of surveying during a large part of the year. In winter the sea is usually too rough to permit accurate work, while in summer when the sea is smooth, fogs and haze abound, cutting off visibility and making sight surveys impossible much of the time. The Coast Survey steamer Guide is now at work off the Oregon coast, using Marshfield as a base.

As to the accuracy of the method, Commander N. H. Heck, who has been supervising the work, states that at a distance of 10 miles from shore it gives the position of the bomb explosion to within a circle whose diameter is the length of the survey ship. This is accurate enough, for the best surveys giving the positions of rocks or other dangers to navigation.

A less accurate modification of the method, cutting out the expensive chronograph on the ship, may be of practical use in navigation. Use of a stop-watch for timing would give an error of at most two tenths of a second, which would enable a vessel captain to work out his position with sufficient accuracy for ordinary navigation.

As to the distance from shore at which this method of sound ranging is practicable, Commander Heck said that during experimental work in Long Island Sound last fall, a small bomb was distinctly heard at a distance of 55 miles.

HIGH ALTITUDE PHOTOGRAPHY

Science Service

A PHOTOGRAPH of the surface of the earth taken from the highest altitude at which any such photograph has ever been made is now on exhibition at the War Department in Washington. The picture is of Dayton, Ohio, and it was taken from 32,220 feet above sea-level by Lieutenants Macready and Stevens, of the Army Air Service, at 11 a. m. on May 2. The altitude is a little more than six miles above Dayton.

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Although the usual ground haze was present when the picture was taken, it is exceedingly clear in definition, and automobiles and street cars can be distinguished in the streets six miles beneath the camera. This result was accomplished by use of a "minus blue" ray filter, which cuts out the blue light of the ground haze. Super-speed film was used, enabling the employment of a very deep ray filter, giving exceptional clearness. As the temperature was 62.5 degrees below zero Fahrenheit when the picture was taken, special electric warming devices had to be used for the camera as well as for the aviators.

According to the experts of the Army Air Service, the use of ray filters to cut out ground haze makes it possible to take pictures of equal clearness at any practicable altitude. The haze occurs up to an altitude of from 8,000 to 10,000 feet, above which the atmosphere is exceedingly clear. The problem is merely one of using a camera with focal length sufficient to get a clear focus on an object six miles or more away. With a focal length of 20 inches they could take a clear picture of the ground from a height of 48,000 feet.

THE NATIONAL CONFERENCE ON OUTDOOR RECREATION

Science Service

OUT-OF-DOOR recreation is now a matter in which continued interest on the part of the federal government and numerous organizations is assured.

As the result of the National Conference on Outdoor Recreation, held in Washington, at the call of President Coolidge, a permanent organization has been effected which will result in a regular annual conference of government representatives, naturalists, scientists, forestry and park experts, sportsmen and representatives of all organizations interested in playgrounds, scout movements, child welfare and other such activities.

At the conference the wild-life and scenic resources of the country were surveyed by delegates from scientific institutions and national and state parks. Every city and town was advised by resolutions of the conference to secure for the general recreational use of its people a piece of land which would be maintained in its wild state as nearly as possible. Action leading to the preservation of wild animals and wild flowers was also recommended.

As the executive committee of the permanent conference, the following were chosen: Chauncey J. Hamlin, New York; Dr. Vernon Kellogg, California; Colonel W. D. Martin, Washington, D. C.; Dr. John C. Merriam, California; John Barton Payne, Illinois; Mrs. Jane Deeter Rippin, New York; George Scott, Illinois; Charles Sheldon, Washington, D. C.; Mrs. John Dickinson Sherman, Colorado; George Shiras, Michigan; James E. West, New York.

THE DETECTION OF MINERALS BY ELECTRICAL METHODS

Science Service Correspondence

UNIQUE methods of electrical sleuthing have resulted in the first discovery of arsenic deposits in Sweden, together with new discoveries of large iron pyrites and copper deposits. A request has been made by the government Board of Trade to the Swedish Riksdag for appropriations to carry on further investigations.

The new mineral finds are in Vaesterbotten Province in the northern part of Sweden. According to preliminary estimates, the new mines when worked will yield annually 350,000 tons of pyrite, 25,000 tons of copper ore and about 40,000 tons of arsenic ore. The last-named ore contains about 30 per cent. arsenic. This discovery is of great industrial significance as Sweden has hitherto been entirely dependent on imports of the commodity. The newly found copper ore contains from 4 to 8 per cent. of copper, while the iron pyrites will yield from 40 to 45 per cent of sulphur.

The method by which the ores have been detected has been invented and employed by Karl Sundberg, a Swedish mining engineer, and illustrates how far this branch of science has advanced since the days of the hazel bough. The testing for ore is made entirely by the use of electrical instruments which indicate not only the whereabouts of ore, but also its nature and quantity. In connection with these tests Mr. Sundberg has engaged in some geologic sleuthing. Whenever he has discovered stray blocks of ore near the surface he has assumed that these have been carried some distance by glaciers, and has consequently assumed the existence of extensive deposits in the direction from which the glacier has apparently moved. This theory combined with the electrical detecting has led to the rich results now reported.

A NEW PROCESS FOR CLEAR FRUIT JUICES

Science Service

PERFECTION of a new process for making apple and grape juice of pleasing color and free from cloudiness has been achieved at the Department of Agriculture.

The new process will make possible the manufacture of juice in large quantities and will cause the use of many varieties of fruit which can not be employed to advantage at present, according to L. C. Corbett, of the Office of Horticultural and Pomological Investigations, who has had charge of the experiments.

Many of the so-called fruit juices on sale at the soda fountains and soft-drink counters are composed of water and sugar with the addition of various flavoring and coloring substances. They are pleasing to the eye and agreeable to the palate, but they possess little or no food value and have practically none of the essential qualities of a natural fruit juice.

The natural juice is very complex in its structure. In addition to the substances which give to it the characteristic flavor and aroma, various gums and gelatins are held in suspension which are difficult to remove and which make the juice turbid and uninviting in appearance.

For several years the Department of Agriculture has been investigating the problem of removing these objectionable elements from the unfermented juice without affecting its quality and color or impairing the taste. It is a problem of many angles. Some varieties

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is used to render the gall bladder opaque during x-ray examination. Preliminary report of the method is given in Journal American Medical Association, page 613-614, Feb. 25, 1924. A copy of the article will be sent upon request.

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of apples, for example, will yield to one method, while others require different treatment.

To make its strongest appeal to the palate of the user, a fruit juice must contain, in addition to its characteristic flavor and fragrance, sugar, tannin and acid in a rather definite ratio. Not many fruits possess these constituents in the proper proportions, and to secure the desired result it is usually necessary to blend or mix the juice of two or more varieties.

By careful selection and combination the department has succeeded in producing an apple juice which is perfectly transparent and of a beautiful color. It retains all the valuable properties of the juice, and will keep indefinitely without fermentation. It can be manufactured in large quantities with the certainty of securing a standard product.

Equal success has attended the experiments with grape juice. By the process employed in the department many varieties of grapes which have not been used on account of the unattractive appearance of the juice can now be made to yield a drink of the highest quality, both as to appearance and flavor.

SUGAR FROM CORN

Science Service

SUGAR from corn may soon be a reality on American breakfast tables. By a process devised at the Bureau of Chemistry, U. S. Department of Agriculture, maltose, an edible sugar, much sweeter than glucose, has been made from cornstarch. It may also be made from hominy or tapioca.

The process does not depend upon chemicals, but is in many respects similar to the natural conversion of starch to sugar in the cells of living plants or animals. The cornstarch is merely mixed with warm water to which malt has been added and the resulting product subjected to the same processes of clarification and evaporation required in the manufacture of cane sugar from sugar cane or sugar beets.

This action of malt has been known to chemists for many years, but has hitherto not been susceptible to commercial production. In practice the results were very uncertain and frequently the whole batch of material spoiled. But now the secret cause of all these troubles has been discovered by H. C. Gore, of the Bureau of Chemistry, and production of maltose from corn on a commercial scale equal to that of glucose is regarded as more than a possibility.

Too many hydrogen ions, not too many cooks, is what spoiled the broth of earlier workers, Mr. Gore found. Hydrogen ions are electrified hydrogen atoms. They split off from many chemical substances in solution, chiefly from acids. They make things taste sour. It is necessary to carry on the reaction in the presence of a certain and carefully controlled proportion of hydrogen ions.

Maltose, although a sugar, is not the same as cane or beet sugar. Neither is it the same as glucose. It is more than twice as sweet as glucose and about three fifths as sweet as cane or beet sugar. It is as wholesome and nourishing as they are.

The United States now consumes about 5,600,000 tons of sucrose, the sugar made from cane and sugar beets. Of this 2,800,000 tons are imported. In addition, we eat in the neighborhood of 1,000,000 tons of glucose. The importance of Mr. Gore's discovery lies in the possible replacement of some of the imported sucrose or home-made glucose by maltose, which is cheaper than sucrose, sweeter than glucose and apparently easier to prepare and which can be produced from the almost inexhaustible source of American grown corn.

Commercial interests are showing interest in Mr. Gore's discovery and in one instance have offered part of their plant equipment for further experiments on a large scale.

ITEMS

THE ninth flight made by Dr. C. L. Meisinger, of the U. S. Weather Bureau, in his series of free balloon journeys taken as part of a study of the atmosphere, ended at Roseville, Ohio, about ten miles south of Zanesville, at 10:20 A. M., May 23. The balloonist and his army air service pilot were in the air a little more than 19 hours after leaving the earth at Scott Field, Belleville, Ill. The distance was about 425 miles. For their next flight, which will be undertaken in a few days, the balloonist will use an 80,000 cubic foot balloon, and hope to be able to remain in the air for two full days.

A REMARKABLE combination of a submarine earthquake and phosphorescent seas has been reported to the Hydrographic Office. The stirring up of the ocean brought so many light-emitting organisms to the surface that the British steamer *Trefusis* on her way from Aden to Colombo seemed to be steaming across a snow-covered plain. It was during the middle watch of March 18, a dark night, quiet sea, and as usual in the northern Indian ocean, the wake of the ship rather brilliantly phosphorescent while the rest of the sea was dark. Just before four o'clock a distinct tremor was felt, followed quickly by others, as if a series of mines were being set off at great depths. Immediately, great patches of light rose to the surface and spread in all directions until for miles around the ship the whole ocean was a brilliant foaming glitter of phosphorescence, the pale blue glow lighting the decks of the vessel with a weird light.

HAFNIUM, the youngest member of the family of chemical elements, is by no means a rare metal, according to figures recently announced here by Messrs. G. von Hevesy and V. T. Jantzen, at the Institute for Theoretical Physics. This condition was suspected by scientists many months ago, when hafnium was discovered. Analyses of minerals from distant parts of the world now show the new metal existing in liberal proportions. Ores from Brazil, France, Greenland, Madagascar, Norway, North Carolina and other locations show from one to five per cent. hafnium. One sample—the mineral alvite—from Kragero, Norway, carried 16 per cent. of the new element. An estimate is made that 1/200,000 of the earth's crust is hafnium. This small fraction represents a large amount of material when the stupendous weight of the earth is taken into account. Hafnium long escaped detection because it was mistaken for zirconium, a metal which usually accompanies it.

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SCIENCE NEWS

THE LAST FLIGHT OF DR. MEISINGER

Science Service

THE storms have conquered. While on his ninth free-balloon flight to study their paths and their causes, Dr. C. L. Meisinger, of the U. S. Weather Bureau, and his pilot, Lieutenant J. T. Neeley, of the Army Air Service, were dashed to earth and killed as a result of the destruction of their balloon near midnight of June 2 over central Illinois. They had left Scott Field, near East St. Louis, about seven hours earlier.

The cause of the disaster will always be a mystery. The balloon was burned in the air, but the cause of the fire may have been either a bolt of lightning or a spark from static electricity. According to Weather Bureau records, thunderstorms occurred at scattered points over central Illinois during the fatal night, and a generally electrified condition of the atmosphere was prevalent.

The balloon, one of 80,000 cubic feet capacity and the largest yet used in the series of flights, was filled with inflammable hydrogen gas, as were all the other balloons used. Officers of the Army Air Service, which furnished the balloon and pilot, when asked why the non-inflammable helium gas, such as is used in the *Shenandoah*, was not used, said the reason was the prohibitive cost. Helium now costs about $90 a thousand cubic feet, so that the expense of having filled the big balloon with it would have been about $7,200 as against about one tenth of that amount when hydrogen is used. The gas used in free-balloons is a total loss, all of it escaping when the descent is made, while the helium used in dirigibles is conserved as much as possible.

Speaking to a Science Service reporter shortly before leaving Washington to begin the series of flights, Dr. Meisinger said that lightning was one of the two things he feared while in the air, and that he would take no chances with thunderstorms. The other peril was that of landing in water. Aside from these two dangers he considered free-ballooning as a safe method of investigating the secrets of the air, and as something of a recreation besides. His service was entirely voluntary, the flights having been taken at his own suggestion which was approved after much consideration by the Weather Bureau authorities. While in the Signal Service during the war, Dr. Meisinger had made a number of flights in balloons and airplanes.

The purpose of the whole investigation was to make the air safer for aviation and to learn more about the ways of storms. On each flight a set of instruments for making a study of atmospheric conditions was taken up and frequent observations made at different levels. None of these results had been reported to the Weather Bureau at the time of Dr. Meisinger's death, as he had been operating from Scott Field, and was on the ground only a few days between flights.

Of all the flights, the first was the longest. It began on the afternoon of April 1, at Scott Field, and ended more than 23 hours later when a landing was made at Walterboro, S. C., about 40 miles from the ocean, the total distance traversed having been about 650 miles. Another long flight ended at Palmyra, Ontario, the near approach of the lake forcing a descent. On another flight the intrepid scientist was carried out over Lake Michigan in a snowstorm, but managed to strike a landward current and make a safe descent in Wisconsin. A thunderstorm caused another premature landing.

In reporting his next to the last flight, Dr. Meisinger told Science Service that he expected important results from this last flight, as he intended, by using the large balloon, to be able to stay in the air 48 hours. He declared he expected it to be "a specially interesting story."

It will be an unwritten one. Mourned by his many friends and associates, and, although only 29 years old, respected throughout the scientific world for his achievements and scholarship, Dr. C. Leroy Meisinger's name, with that of his army pilot, Lieutenant James T. Neeley, will go down on that long roll of scientists who died martyrs to human progress.

JUPITER AND SATURN

Science Service

THE two largest planets of the solar system, Jupiter and Saturn, are now in fine position for observation in the evening.

Saturn will be found nearly due south at 9 o'clock in the evening in the constellation of Virgo, The Maiden. It is yellowish in color and about twice as bright as the white, first magnitude star Spica, the brightest star in Virgo, lying a little to the west of it.

Jupiter is just appearing above the southeastern horizon at this time and is by far the brightest object in view, now that Venus is drawing in toward the sun and setting earlier in the evening. On the date of its opposition with the sun, June 5, Jupiter will be on the meridian at midnight and will be visible throughout the night.

If it were possible to take the stuff of which these two huge worlds are made and fashion them into many balls the same size as the earth, 1,309 earth-globes could be made out of Jupiter and 760 out of Saturn, not counting the material that exists in Saturn's rings. This would be by no means a negligible quantity for though the rings are mere sheets, scarcely one hundred miles in thickness, their width is enormous. The inner, dusky ring is nearly eleven thousand miles wide, the middle or bright ring is eighteen thousand miles wide, and the outer ring which is less bright than the middle ring is 11,000 miles wide. These widths total nearly 40,000 miles, more than half the diameter of the planet itself. Then there are the satellites, ten belonging to Saturn, nine to Jupiter. These are good-sized worlds, some of them larger than our moon, two as large, or larger, than Mercury. We could get a few more globes as large as our own from this material.

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Compared to our own substantial planet, though, these globes would be rather flimsy worlds. The material of which Saturn is made has only six tenths the density of water. A ball made of it would float, like those the children toss about in the water in summer. The Jupiter globes would be more molasses-like in their consistency or rather like the dense, compressed vapors of which the main body of the sun consists. The sun and Jupiter are almost the same in density and Jupiter is believed to be a very small sun that has cooled off.

Compared with these globes, our own earth, with an average density twice that of its surface rocks, is like a ball of iron. Possibly our earth has a core of iron. Its interior may be made of the same stuff as the iron meteorites that get trapped by the earth's atmosphere now and then and fall to the surface of the earth. Some think these are fragments of an exploded world or remnants of the stuff from which the solar system was originally fashioned.

Now is an opportune time to take a look at either of these giants of the solar system. Even a small, three-inch telescope will show much that is interesting on either of them. The rings of Saturn are now well opened up and present a unique and beautiful sight. You may see the belts running parallel to the planet's equator and at least one or two of the brighter satellites. On Jupiter the belts can be seen very clearly, and the white spots and splotches of color, too. Perhaps there will also be visible a satellite or its shadow projected on the disk. Or, by chance another of its satellites may be caught suddenly disappearing as it dips into the shadow of the huge planet.—*Isabel M. Lewis.*

"CRATERS OF THE MOON"

Bulletin of the National Geographic Society

"Craters of the Moon" is the United States' youngest national monument.

On May 2, President Coolidge signed the order setting aside a little-known district in Idaho for a national monument. It is a wild, colorful region containing one of the most unusual volcanic fields in America. From the twisted brilliant contours of frozen lava fields and crimson cones and the absence of verdure, it takes its official name, "Craters of the Moon National Monument."

Of "Craters of the Moon," lying along the Lincoln highway between Carey and Arco, Idaho, R. W. Limbert writes in a communication to the National Geographic Society: "Although almost totally unknown at present, this section is destined some day to attract tourists from all America, for its lava flows are as interesting as those of Vesuvius, Mauna Loa or Kilauea. The district consists of some 63 volcanic craters, lava and cinder cones, all at present extinct or dormant. The largest and most conspicuous is 600 feet high, rising in the midst of a belt of craters two or three miles wide and 30 miles long. The major flows, the Blue Dragon Flow and the Pahoehoe Flow roughly parallel the Lincoln highway and are but two to five miles from it. A wagon trail from the national road goes into the rocky volcanic desert a short way.

"Stretching to the southwest for about 11 miles, we saw perhaps one of the most remarkable lava flows in the world," continues R. W. Limbert, describing the Blue Dragon Flow. "Its color is a deep cobalt blue with generally a high gloss, as if the flow had been given a coat of blue varnish. The surface is netted and veined with small cracks, having the appearance of the scales of some prehistoric reptile. It merits the name Blue Dragon, as in many places it has burst through the crevasse of an older flow, and the ropy twists of blue lava spreading out in branches, together with its scaled surface, need but little stretch of imagination to suggest the claws and legs of a dragon.

"In appearance the 'Craters of the Moon' flows seem as if they had happened only yesterday, but in reality the latest probably occurred about 150 or possibly 200 years ago. The total area of the six young lava flows is about 300 square miles, while that extending above and below this point along the Snake River plains reaches the astounding total of approximately 27,000 square miles. Of the 300 square miles of lava desert, some 40 square miles have been set aside by President Coolidge. 'Craters of the Moon Nationa Monument' is about 150 miles southwest of Yellowstone National Park.

"Picture yourself standing in some vast amphitheater whose towering walls are a riot of yellow, green, orange, brown and black, with brick red and vermillion predominating," Mr. Limbert writes in describing the district. "Imagine, too, an awesome, enveloping silence. I noticed that at places we had nothing to say. It was little wonder the Indians feared and shunned the region.

"East of the Bridge of Tears we came to the entrance of what we afterwards decided to call Amphitheater Cave. Climbing down, we found ourselves on the east side of a room some 40 feet wide and 60 feet long, with a domed ceiling 20 feet high. As we sat on the north side, we beheld to the south a perfect stage. The floor was double, the lower section being about 8 feet lower than the top of the floor above, which was 15 feet wide. It was almost an exact model of a modern theater. At the top of the dome the roof had caved in, leaving a circular skylight 6 inches in diameter.

"By lining flights of doves, five water holes were located in old volcanic blowholes or fumaroles. Dipping up a cupful of water we were astonished to find it icy cold, so cold, in fact, that it hurt our teeth, and we put the cup down on the hot rocks to warm. This phenomenon can only be accounted for by the supposition that it was the seepage water from one of the ice caves, of which we found a number. One water hole was covered with an inch coat of drowned hornets that had been chilled and had fallen in. The water underneath was pure and sweet. We called this Yellow Jacket Water Hole."

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Yale University News Statement

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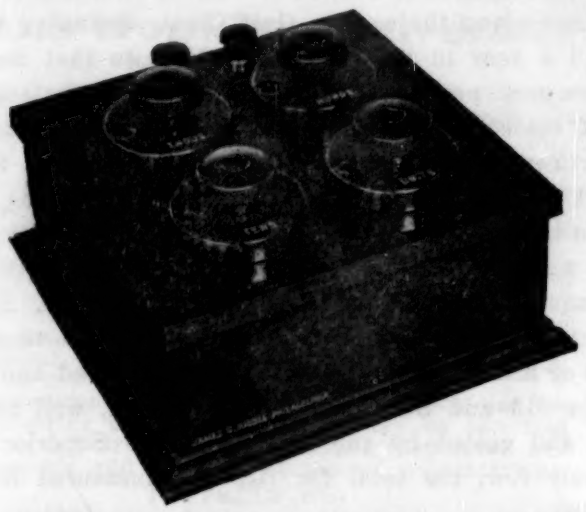

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years of research work by Professor Leo F. Rettger, of Yale University, has been put on the market as a therapeutic agent and a beverage to be dispensed at soda fountains, etc. The preparation is designed to supplant with a harmless bacterium (*Bacillus acidophilus*) the fermentative and putrefactive bacteria in the intestine which have been found to be the cause of many ailments such as constipation, diarrhea, colitis, sprue, etc.

Through experiments on the white rat, Professor Rettger and his students determined that the addition of milk or sugar of milk to a fixed diet resulted in a large and rapid increase in the number of *Bacillus acidophilus* present in the intestine, with a corresponding decrease in the harmful types. They also discovered that the best methods could be obtained by feeding a preparation containing the bacilli themselves, particularly acidophilus milk, this treatment resulting often in a 95 per cent. implantation in from four to six days.

The experiments were transferred to man, first to normal subjects and then to persons suffering from chronic constipation, chronic diarrhea, colitis, sprue and dermatitis (eczema). With the consumption of the *Bacillus acidophilus* milk, in varying quantities, it was found that the condition of the patients improved rapidly and that in most instances these ailments were cured.

During the past two years Professor Rettger and his associates have sent stock cultures to almost all parts of this country and to foreign countries for the production of the acidophilus milk. They have found that large concerns are able to produce a pure and uniform product under proper supervision. Eventually they hope that its manufacture will be completely under the control of a central laboratory or laboratories.

The preparation of the milk requires unusual skill and care in order to prevent contamination. Fresh skimmed cow's milk is sterilized, cooled and inoculated with a pure strain of *Bacillus acidophilus* which has been grown in and accustomed to milk a sufficiently long time to develop rapidly and bring about coagulation of casein within twenty-four hours. At the end of this time the casein appears as a soft curd, with a very thin layer of whey; when shaken it assumes the consistency of thin cream. Both odor and taste are pleasant. This is taken daily in quantities varying from a pint to a quart, with or without the addition of sugar of milk, in accordance with the requirements of the individual. It may also be taken as a healthful and appetizing beverage.

THUNDERSTORMS IN SAN FRANCISCO

Science Service

ACCORDING to 20 year records compiled by W. H. Alexander, of the U. S. Weather Bureau, San Francisco has fewer thunderstorms than any other inhabited place in the United States. Only 31 thunderstorms occurred in the Pacific Coast City in the years 1904 to 1923 inclusive.

The place with the most thunderstorms is Tampa, Florida, which scored a total of 1,883 in the same period. Another place whose inhabitants are accustomed to lightning flashes and rolling thunder is Sante Fe, N. M., where 1,456 storms occurred in 20 years.

For the year as a whole, thunderstorms have been found to be most abundant in the lower Mississippi valley and along the eastern Gulf Coast, averaging more than 50 a year in those regions. Next to that section they are most prevalent in New Mexico. In the eastern half of the country the number gradually diminishes to the northwards. In the 20 year period, Charleston, S. C., had 1,174, Washington 792, New York 612, Boston 377, and Halifax, 100.

The number is least near the sea, increasing inland. For example, in the two decades, Syracuse, N. Y., in about the same latitude as Boston, had 676 thunderstorms or nearly twice as many, while Cleveland had 757, Chicago 813 and St. Louis 1,000. Duluth, well to the north, and cooled by the water of Lake Superior, has relatively few, the total for the time measured having been 589.

ITEMS

Science Service

THE modern industrial worker is becoming hatchet-faced. In a recent lecture, Sir Arthur Keith stated that comparisons of modern skulls with those of earlier times showed a distinct tendency for the face to become longer and narrower. This same tendency will probably be found to be the result of a disturbance of the elaborate system of hormones or internal gland secretions, and this disturbance also manifests inself in such other abnormalities as enlarged tonsils, irregular teeth and contracted palates. Dr. Keith also suggested that the interference with the normal development might ultimately be due to some cause underlying modern industrialism such as a diet in which some vital quality was missing, or to insufficient light. His researches had shown, he said, that, whatever the cause, the shape of the mouth was changing, the palate becoming more narrow and the face longer. These conditions were not found in England until after the development of industrialism in the eighteenth century. Keith has shown that 25 per cent. of modern Englishmen suffer from dental abnormalities unknown in the bronze age, and that while the upper and lower teeth of early man met evenly, the upper teeth of modern men overlap the lower.

THAT grain fertilized by manure produced by living creatures has more nutritive value than grain fertilized by the best known combinations of artificial fertilizers is indicated by experiments recently carried out at the agricultural station in India. Grain grown from land artificially fertilized was found to be lacking in vitamins as compared with grain grown from soil fertilized with animal manure. The report of the work is published in a recent number of the *British Medical Journal*. The experiments were conducted with pigeons, fed a diet of natural millet. The birds fed with millet grown from artificially fertilized land tended to develop the characteristic paralysis resulting from vitamin deficiency and they also suffered loss of weight. It was found that the efficacy of grain in promoting nutrition and preventing beri-beri bore no relation to the yield per acre, for although land well fertilized by artificial materials gave twice the yield of well-manured soil, the grain from the latter was decidedly the best in the content of vitamins.

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SCIENCE NEWS

THE TROPICAL PLANT RESEARCH FOUNDATION

Science Service

RECOGNITION of the large and increasing importance of the part played in the economic life of the temperate zones by the products of the plants of the tropics is seen in the incorporation of the Tropical Plant Research Foundation by some of the leaders in the United States in the knowledge of tropical plants. The foundation was initiated during the past year by a committee of the National Research Council and was incorporated June 6 in the District of Columbia.

The particular objects of the foundation will be to promote the study of the plants and crops of the tropics, to conduct investigations and to publish the results of them, and to establish and maintain such temporary or permanent stations and laboratories in tropical countries as may be necessary for the accomplishment of these objects.

The necessity for this study is stated by the organizers of the foundation to be the economic dependence of the temperate zones upon the tropics, from which come many of the necessities of modern life. This dependence will increase in the future. The quantities of sugar and oils, fiber and rubber, coffee and cacao, fruits and vegetables that are imported annually are only the vanguard of the future supplies that will be drawn from the tropics. The production, preparation and shipment of these products involve problems that have as yet received little study. With the exception of the areas under the immediate jurisdiction of the United States, the tropical agriculture of the western hemisphere does not have the counterpart of the governmental and institutional agencies which contribute so much to crop production within the United States.

The industrial importance of the scheme is recognized in the board of trustees, four of whom will represent industry. The other five will be scientists, chosen from several national societies more closely identified with the projected work. The initial board consists of George P. Ahern, former chief forester of the Philippines; J. T. Crawley, former director of Cuban and Porto Rican experiment stations; V. M. Cutter, of the United Fruit Company; Dr. William Crocker, director of the Thompson Institute; Dr. R. A. Harper, National Research Council; Dr. L. R. Jones, head of the department of plant pathology at the University of Wisconsin; H. C. Larkin, president of the Cuba Railway Company; Dr. S. C. Prescott, of the Massachusetts Institute of Technology, and Dr. D. L. Van Dine, of the American Society of Economic Entomologists. The scientific director and general manager will be Dr. W. A. Orton, now with the Bureau of Plant Industry of the U. S. Department of Agriculture.

Dr. Jones will be the first president of the foundation, and Dr. Harper will be vice-president. The administrative headquarters will be in Washington. Much of the laboratory work will be done at the Thompson Institute, Yonkers, N. Y., and field laboratories will be established in the tropics as needed.

GRADUATED AMPLIFIERS AS AN AID TO HEARING

Science Service

THREE-STAGE amplifiers, with means for delivering voice currents of several different volumes, is the latest method of helping the partially deaf to hear. Prediction of the eventual equipment of all places of public assembly with such devices was made by Dr. Harvey Fletcher in an address recently to a convention of the American Federation of Associations for the Hard of Hearing. Many of his audience were using such a system.

Loudness alone is not the open sesame for the hard of hearing, according to Dr. Fletcher. Studies made under his direction in the research laboratories of the American Telephone and Telegraph Company and the Western Electric Company show that people whose hearing has been reduced by more than 60 per cent. can possibly be benefited by an amplifier, but they will never be able to understand what is said as well as persons whose hearing is better than 60 per cent. Hence the disappointment of many whose desire to reestablish communication with their fellow-men has led them to believe extravagant claims of certain unscrupulous deaf set manufacturers.

In explaining to his audience how the proper loudness is determined, Dr. Fletcher brought out several interesting points. A person having 30 per cent. less hearing than normal will have little difficulty in understanding ordinary conversation at three feet from the speaker. One having 40 per cent. less would miss many consonants, but could still follow the conversation by paying close attention. One who has 50 per cent. loss can hear only the vowel sounds, and can not understand unless the speaker talks loudly or close to his ear. With a 60 per cent. loss, nothing would be heard at all with the speaker three feet away, but by talking as loudly and close to the ear as possible, much can be understood. For greater deafness, no amount of loudness will be of much service, as the upper limit of the ear's response has been reached, and further increase will be painful or even injurious.

As a practical means of telling whether any device will be of assistance, Dr. Fletcher gave the following simple test: Have a friend speak simple sentences directly into your ear. If you can interpret them without difficulty, then a hearing aid can be designed which will make it possible to obtain the same interpretation. But if the speaker raises his voice to a very loud tone and you are still unable to understand, then probably no aids on the market can assist you.

The fallacy that deafened persons can hear better in noisy surroundings was disposed of by Dr. Fletcher with this explanation: The effect of noise is the same as an impairment of hearing. Noise in the average room is

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CANCER SERUM

Science Service

DOUBT as to the alleged efficacy of the curative serum for cancer said to have been produced by Dr. T. J. Glover, of Toronto, was expressed by many of the 15,000 physicians and surgeons assembled at Chicago for the conventions of the American Medical Association and affiliated societies.

It was pointed out by leaders of the American Medical Association that as long as three years ago Dr. Glover had made claims of being able to cure cancer. These claims were circulated among physicians with statements that the charge for one dose of the treatment would be five dollars and that at least five treatments must be given. The *Journal of the American Medical Association* quoted these claims in the issue of January 1, 1921.

The American Medical Association then referred the assertions of Dr. Glover to the Academy of Medicine, of Toronto, his home town, and a summary of their report was published in the *Journal of the American Medical Association* of February 5, 1921.

This report stated that "the data examined has not convinced the committee that the results obtained by the use of Dr. Glover's serum were better than those obtained by similar methods introduced by others, and which have ultimately disappointed the hopes entertained of them." It was further stated that Dr. Glover had declined to permit the committee to visit his laboratory or to examine his cultures or experimental material, and had not acceded to the request of the committee that he demonstrate his ability to produce cultures of cancer cells, to produce cancers by inoculation and to immunize animals against it.

Dr. Morris Fishbein, assistant to the editor of the *Journal of the American Medical Association*, in referring *Science Service* investigators to these published statements, said:

"Evidence indicates that controlled tests of the Glover cancer serum made by Francis Carter Wood, director of cancer research, Columbia University, show that the treatment has not the slightest effect on the growth of tumors of animals. The Glover method is in no sense established as either scientific or reliable."

AN ELECTRICAL DEVICE FOR PLOUGHING

Science Service

AN electrical method for making ploughing easier has been invented by E. M. Crowther and W. B. Haines, of the Rothamsted Experimental Station, England.

A large part of the work done in ploughing is "wasted" as friction between the mouldboard and the soil. The idea behind the present method is to use the soil moisture to lubricate the mouldboard.

By insulating the coulter of the plough and passing a current from it through the soil to the mouldboard the water in the film surrounding the soil particles is caused to move to the mouldboard, where it acts in the same way as water put on tools by men digging in sticky soil.

The inventors have demonstrated the method, both by small scale experiments in the laboratory and by actually measuring the work done by a tractor in ploughing both with and without a current flowing as described. A self-contained unit was formed by having a 110-volt dynamo mounted on and driven by the tractor. On the electrified plots the tractor engine had the extra load imposed by the dynamo. In spite of this it was noticed that the engine "eased-up" over the electrified plots and the time records showed that the speed of ploughing was increased. The current in this case was 1 to 2 amperes per plough.

Though the inventors claim that the device has reduced the work done in ploughing, they say that the amount of this reduction is not sufficiently great to have any immediate practical value. Up to the present they have used the ordinary plough, modifying it the minimum possible, but they are hoping to develop the idea further along such lines as adapting the plough to this particular purpose and in its application to special types of soil which give trouble in ploughing and to mole drainage.

RECENT WATER POWER INVESTIGATIONS MADE BY THE GEOLOGICAL SURVEY

Department of the Interior

ENGINEERS of the Geological Survey, Department of the Interior, surveyed 1,150 miles of rivers, mapped 46 dam sites and 21 reservoir sites, and made records of stream-flow at 1,600 gaging stations in 1923. Geologists of the survey examined the geologic structure at more than 50 proposed dam sites. The data gathered through the field work were analyzed and incorporated in reports on stream flow, water power and irrigation. The estimated potential power available 50 per cent. of the time on the streams surveyed amounts to 2,500,000 horsepower.

Water-power investigations must necessarily be made where the fall of the streams is greatest, and therefore much of the work is done in mountainous areas, where the population is scant and scattered and the means of communication are poor. The surveyors must follow the rivers, so that in many regions supplies can be carried only by pack train or by boat. As little baggage as possible is carried, for camp is moved almost daily.

About 200 miles of Colorado River were mapped, 24 dam sites were surveyed, and a geologic examination was made at each site. In this survey three boats furnished the only means of transportation. Accounts of this trip through the Canyon of the Colorado, relating its perilous adventures and its scientific results, have already been widely published. The water available for developing power in the canyon section of Colorado River is measured at gaging stations at Lees Ferry, Bright Angel Creek, in Grand Canyon National Park, and Topock. The measurements are made by current meters operated from cables, and the river stages are recorded by automatic gauges.

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tributaries, 13 dam sites and five reservoir sites were mapped. In its upper stretches the river flows through an area traversed by good roads, but in its lower stretches there are no roads, so that boats were used. In its lower part, from Grant's Pass to the mouth, the river is very swift and difficult to run, but the survey boats made the trip without an upset. At one point, however, the rock walls approach each other so closely that one boat which was turned sideways by the current was lifted on a wave in such a way that it lodged between the walls, one end on each side, clear of the water. By good fortune the boat when pried loose was headed into the rapids and came throngh unharmed.

In the survey of Illinois River, a tributary of the Rogue, a pack train was used, except around Bald Mountain, where no trail follows the river. Here the supplies were transferred to a boat, but when the party had gone to more than half way around the mountain they encountered boulders so large and so close together that further progress by boat was impossible. The surveyors were then compelled to carry their instruments, food and bedding through a narrow canyon, whose sides were either densely wooded or consisted of bare, precipitous rock. In the bed of the stream deep pools alternated with rapids strewn with immense boulders. Progress along such a stream is slow and laborious. Many times the party climbed the steep sides of the canyon to avoid a pool only to be forced back by a precipitous cliff. The rock walls of these gorges, however, furnish excellent abutments for dams, and at such places the power development causes a minimum of damage to property.

Records of the daily flow of Rogue River are made at Prospect and Tolo, Oregon, and similar records are made on many of its tributaries.

Klamath River, in Oregon and California, was mapped for 100 miles, this work completing the survey of this river and its larger tributaries. Seven dam sites and two small reservoir sites were surveyed. A reconnaissance investigation was made of the power possibilities on Smith, Trask, Nestucca, Nehalem and Wilson rivers in western Oregon.

The western tributaries of South Platte River from Denver to the Colorado-Wyoming line were mapped, as well as Sweetwater and Encampment rivers, in Wyoming. In Colorado and Wyoming 460 miles of river surveys were made, and 14 reservoir sites and 12 dam sites were mapped.

ASPHYXIATING GAS STIMULATES BREATHING

Science Service

How the presence of carbon dioxide gas in the lungs stimulates breathing in asphyxiated persons, in spite of the fact that they may have been suffocated by too much of the same gas, was explained to members of the American Medical Association recently by Professor Yandell Henderson, of Yale University. In a method devised by him, carbon dioxide, which is always present in exhaled breath, is regularly and successfully used to start breathing in persons who, as the result of suffocation or other cause, have ceased to breathe.

The reason for this, Professor Henderson said, is that carbon dioxide in the lungs and blood is normally necessary to stimulate the nervous centers which control respiration. If a person who has been partly suffocated is given pure oxygen to breathe, or even fresh air, they not infrequently cease to breathe at all, due to the fact that pure oxygen in the lungs depresses the breathing nerve centers. The reason why people breathe heavily after exertion is because the exercise has burned more bodily fuel, and carbon dioxide has accumulated in the system.

Professor Henderson and his associate, Dr. H. W. Haggard, have devised a breathing apparatus which automatically feeds about 5 per cent. of carbon dioxide to the patient. This stimulates deep breathing and enables him to get rid of such really poisonous gases as carbon monoxide, which may have caused his collapse. Patients who have been treated in this way, instead of suffering for several days from severe headaches, are perfectly well in a few hours, and firemen who have been revived at fires are able to get up immediately and go on with their battle. The method is also used after anesthesia and generally in all classes of respiratory failure.

ITEMS

Science Service

THERE are 3,000,000 industrial accidents in the United States every year, besides an unknown total from motor vehicles, agricultural machinery and the many new hazards in play and in home life. These figures were given by R. M. Little, director of rehabilitation of the state of New York, in an address before the American Medical Association. To remedy this situation, the federal government and 36 states have established rehabilitation service for the physically handicapped, Mr. Little said, these bureaus are now caring for more than 11,000 active cases, and during the year ending June 30, 1923, they restored to economic independence 4,350 handicapped persons. It is estimated by Mr. Little that the injured were restored to active economic life at a cost of $253.84 for each person.

THE woodchuck or groundhog is facing extermination in regions where he is numerous enough to do material damage to farm crops. Difficult to hunt or trap, the little animal has always managed to survive even in thickly settled regions. But now the U. S. Department of Agriculture has found an easy and cheap way to kill them. One method is by a gas attack. Carbon bisulphide, a very poisonous liquid that vaporizes at a low temperature, is dropped down their burrows. The vapors are much heavier than air and sink to the bottom of the hole, where the woodchuck is taking his winter's nap, a nap from which he never awakens. The other method is to sprinkle flakes of calcium cyanide about the entrance to the digging. This is a deadly poison, and it gives off hydrocyanic acid gas, which is even more deadly.

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SCIENCE NEWS

DRUG ADDICTION IN THE UNITED STATES

Science Service

THERE are now probably not more than 150,000 drug addicts in the United States, and their number is decreasing, according to a report just published by the U. S. Public Health Service. This report is the result of a study of the extent and trend of drug addiction in the United States made by Dr. Lawrence Kolb and A. G. Du Mez, pharmacologists of the Public Health Service. It finds the peak of drug addiction was reached about 1900, when there may have been more than 250,000 addicts, and that the number is now steadily on the decline.

The estimate is based on the findings of numerous investigators and the reports of physicians and of addiction clinics during the past 25 years. The highest estimate, made in 1915, gave a total of 269,000 victims. The lowest, based on the experience of the army draft figures, gives a total of 99,500. The former was made in the state of Tennessee and is believed to have been too high, since investigators found that there were proportionately more addicts in the south than in the north.

The reasons for the conviction of the investigators that drug addiction is decreasing are given as the increasing efficacy of measures for the control of the drug trade, the prohibition of imports of smoking opium and the increasing caution exercised by physicians in prescribing habit-forming drugs.

Estimates of the maximum total number of addicts are also derived from the known amount of drugs imported, and the report states that "to supply with their daily dose the large number of addicts asserted by some to be residing in this country would require enormous quantities of narcotics—quantities far in excess of those imported at the present time or during any period in the past!"

The period of the greatest importation of opium per capita was the decade ending with 1900. Assuming that all of it was used to supply addicts with either opium or morphine, the total number of victims could not have been more than 246,000. The report adds that the substitution of heroin for morphine would only increase this total by 12 per cent., and the imports of opium at present are less than one fourth that of 25 years ago. The importation of smoking opium is forbidden.

As to cocaine, the report states:

"The amount of cocaine produced in the world as well as that imported into the United States has always been small in comparison with opium. The number of addicts in the United States using cocaine alone, based on legitimate importation and assuming that all the coca leaves and cocaine imported annually was used for the satisfaction of addiction, could never have been more than 18,300."

There are more addicts in prison at present as compared with former years, but this the investigators believe to be due to rigid enforcement of recent laws and not to any increase in addiction, since they hold that the present known importations are hardly more than the legitimate needs of medicine. Prison addicts are also thought to be due to the increase in the delinquent type of addict as compared with the normal individual who became an addict from medical use. Few cases of recent addiction, the investigators say, can be attributed to the prescribing of the drugs by physicians.

From the trend which narcotic addiction in this country has taken in recent years as a result of the attention given the problem by the medical profession and law enforcement officers, it is believed that we may confidently look forward to the time, not many years distant, when the few remaining addicts will be persons taking opium because of an incurable disease, and addicts of the psychopathic, delinquent type who spend a good part of their lives in prison.

LIQUID AIR FOR TREATING OAK POISONING

Science Service

LIQUID air as a remedy for poison oak troubles is the recent discovery credited to George F. Nelson, technical expert in the Gilman research laboratory of the University of California. Results of the new treatment have proved so remarkable that the university infirmary is now using about twelve gallons of the frigid liquid per month. The Berkeley hills are infested with the notorious western poison-oak (*Rhus diversiloba*), the bane of numerous lovers of the outdoors. Acting much like its ill-reputed eastern cousin, the poison-ivy, this plant has always been a great disturber of peaceful student life.

By the new technique a wad of cotton is soaked in liquid air, thereby being chilled to a temperature of about 300 degrees below zero Fahrenheit. It is now dexterously rolled over a blistered poisoned skin for a time just long enough to freeze a very thin layer, after which the pustules and itching are said to disappear promptly. The treatment seems also to be promising in cases of eczema and particularly with ringworm.

Years ago federal experts developed satisfactory means of prevention of oak- and ivy-poisoning, but found no cure. The poison is a non-volatile oil which is easily rubbed off from the leaves of the plants upon the skin of the victim. Following its slow absorption an acute irritation is set up just beneath the skin. If a sensitive person is forewarned he may readily eliminate the danger by dissolving the oil in a grain-alcohol wash, to which lead acetate, a chemical obtainable at any drug store, is added. The lead acetate, dissolving in the alcohol, gains direct access to the poison, which it chemically destroys. A final brisk treatment with strong soap and water eliminates all residues.

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FOOD RESOURCES OF THE TROPICAL ISLANDS OF THE FAR EAST

Science Service

LAND enough to supply all the food wants of Japan, China, the Philippines and other countries in eastern Asia exists in the tropical islands of the far east, Dean E. D. Merrill, of the College of Agriculture of the University of California, told members of the Pacific division of the American Association for the Advancement of Science, at the recent meeting at Stanford, California.

Borneo, Sumatra and New Guinea, each of them larger than Japan proper, have a combined population of less than 9,000,000 as against 70,000,000 persons in Japan. Java supports a population half as large as that of Japan on a territory only about 30 per cent. as large. The future food supply of the east will have to come largely from these great areas of untilled land in the tropics, Dr. Merrill said.

Even in China there is room for a considerable expansion in food production, if rinderpest, a cattle disease which makes cattle raising unprofitable there, could be eradicated, the speaker said. Large areas of China are typical grazing land, and while the country imported large quantities of rice, it exported a great many food specialities, particularly eggs.

"Unless one has traveled in the Malay archipelego, one's ideas as to the size of the region are apt to be rather hazy," Dr. Merrill said. "If a map of the archipelego be drawn to the same scale and placed over a map of the United States, the northern end of Sumatra would appear on the coast of northern California, Oregon or Washington, while a large part of the great island of New Guinea would extend into the Atlantic ocean.

"To these vast undeveloped areas may be added large regions in the Malay peninsula and the Philippines. It would seem desirable to develop some of these regions as basic food-producing areas, and this development may be forced, in the not distant future, by changing economic conditions. To develop these countries, however, labor must be available in the form of largely increased population; yet there is always the personal element to be considered in that Malay peoples are in no sense colonizers."

THE DENSITY OF THE GASES IN THE STARS

Science Service

PRESSURE in the interior of the stars is so immense that it breaks the molecules of matter apart, with the result that gases may be compressed to the density of metals and yet behave as gases, writes Professor A. S. Eddington, English astronomer, in a recent publication. The compressibility of gas under earthly conditions, says Professor Eddington, depends upon the size of the gas molecules, which in turn depends upon the number of electrons it contains and upon their orbits about the central nucleus. Gas molecules behave somewhat as rigid spheres, and a limit to possible compression is reached when the spheres become tightly packed.

But at the high temperature within the stars these spheres are all broken up and a rearrangement of their parts or electrons becomes a possibility, much as a complicated machine if taken down may be packed into a smaller space. So Professor Eddington sees no difficulty in assuming that true gases as heavy as platinum, or 20 times as heavy as water, may exist in the interiors of some of the stars.

Similarly, he finds it possible that solid matter may be so compressed as to have a density of 50,000 times of water or inconceivably greater than anything of which we have any direct knowledge. Such a condition is indicated in the make-up of the star which is a faint companion to Sirius, the brightest star in the sky. This little star apparently has a diameter only about three times that of the earth, while its mass approaches that of the sun. As a result, its density should be about 50,000 times that of water.

A NEW SOUNDING METHOD USED BY THE U. S. COAST AND GEODETIC SURVEY

Science Service

ACCURATE determinations of the velocity of sound in sea water, which will make possible the further development of the sonic depth finder in marine survey work, have been made by the U. S. Coast and Geodetic Survey. The speed of the sound waves under water has been found to vary so greatly with the temperature, pressure and salinity that unless these are known the sonic method of sounding the depths of the sea is apt to be inaccurate. The problem has been to work out some sort of theoretical velocity which might be safely used in this work.

The oceanographic cruise last fall of the Coast and Geodetic Survey steamer, *Guide*, from the east to the west coast by way of Porto Rico and the Panama Canal and the subsequent work of that vessel on the Pacific coast led to results which went far toward a solution of this problem. Wire soundings were taken at many places ranging in depth up to more than five miles. Sonic soundings were taken at the same time, and the temperature of the water and its salinity measured or calculated for various depths.

As a result, it has been found possible to deduce a theoretical velocity for the sound waves at many places and under differing conditions which when used for computing depths by the sonic method and compared with those obtained by wire soundings showed very slight errors.

The sonic depth finder was developed by Dr. H. C. Hayes, of the Naval Research Laboratory, Bellevue, D. C. It measures the time taken for sound to travel to the

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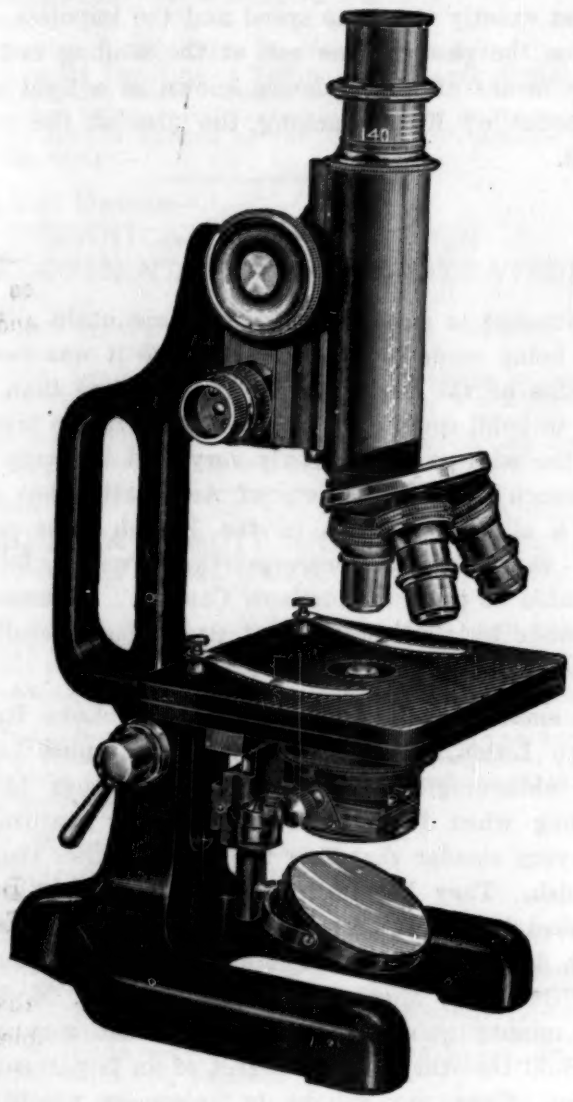

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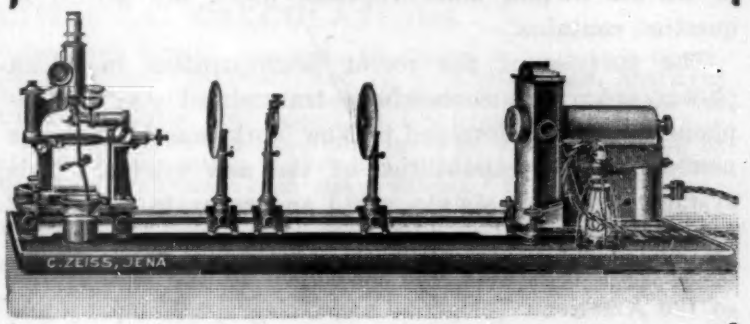

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bottom of the ocean and back again and has been used for deep sea soundings by navy vessels in various parts of the ocean, especially off the southern California coast. Sound travels in sea water at a speed of from 4,800 to 5,000 feet a second, and the importance of determining this velocity accurately, if accurate soundings are to be made, is evident.

STATEMENT ON WIRE TRANSMISSION OF PHOTOGRAPHS BY R. W. KING

I NOTICE in SCIENCE, for May 30, an article entitled "Wire Transmission of Photographs," which was circulated by Science Service. I beg a little additional space to correct certain misconceptions which the article in question contains.

The purpose of the recent demonstration in which photographs were successfully transmitted over a telephone line from Cleveland to New York, was to show the newspapers the capabilities of the new system. This system provides a simple, rapid and accurate method of transmitting pictures which will operate over a telephone line. The apparatus was developed in the laboratories of the American Telephone and Telegraph Company and the Western Electric Company and represents the association of many recent inventions together with standard types of telephone and telegraph apparatus which have been readapted to this new use. The development work has been carried out by a number of engineers and in due course technical articles describing the apparatus will appear under their names.

Regarding the future use of the system, officials of the two companies announced, at the time of the demonstration, that the extent to which it is installed on our various long distance telephone lines will depend entirely upon the demand which arises for such a service. As has been demonstrated in previous tests, the system is also applicable to radio transmission of pictures when atmospheric conditions are such that steadiness of transmission and freedom from interference can be assured.

The simplicity of the method is such that a positive transparency film is at once ready for transmission. The apparatus is so designed as to transmit a picture five inches by seven inches in a little less than five minutes. The picture is received in such form that after photographic development of the usual sort, it is ready for newspaper or other reproduction. Line drawings, handwriting and printing, when not too small, can also be transmitted. As films can be used for transmission while still wet, this system eliminates the delay which would otherwise be caused by drying.

The film upon which a picture has been transferred is inserted in the transmitter simply by rolling it up in a cylindrical form. During operation a very small and intense beam of light shines through the film onto a photoelectric cell within. The film is rotated at a uniform speed and by means of a screw mechanism is caused to advance parallel to the axis of the cylinder. The motion of the light relative to the cylinder is therefore the same as that of a phonograph needle relative to a cylindrical record. In this way, each minute portion of the picture in turn affects the intensity of the light reaching the photoelectric cell. This variation in the amount of light striking the sensitive surface of the cell gives rise to a current which, through the agency of a vacuum tube amplifier and modulator, controls the current flowing through the telephone line.

At the receiving end an unexposed photographic film is rotated under a beam of light in a manner similar to that at the transmitting end. The two films are caused to rotate at exactly the same speed and the impulses starting from the photoelectric cell at the sending end control, by means of a new device known as a light valve, the amount of light reaching the film at the receiving end.

ITEMS

Science Service

AN attempt to raise silver foxes in mountain altitudes is now being made in France. Hitherto it was assumed that skins of the finest texture, worth more than their weight in gold, could only be grown in northern latitudes where the winters are not only very cold but very long. The French National Society of Acclimation has established a silver fox farm in the French Alps on the theory that the temperatures there would be just as suitable as those of northern Canada. An announcement made by them states that preliminary results are satisfactory.

THE smallest fish in the world live in Lake Buhi in southern Luzon, the largest of the Philippine Islands. These ichthyological midgets are only about half an inch long when full grown and sexually mature, and are so very slender that they are much smaller than any other fish. They belong to the family of gobies, distinguished by a sort of sucking disk used for attaching the fish firmly to stones. The only big thing about this fish is its name, Mistichthys Luzonensis, H. M. Smith. These minute gobies occur in such vast numbers in Lake Buhi that they are the object of an important local industry. They are caught in enormous numbers by means of cloth nets and are not only used in the towns along the shores of the lake but are also shipped for considerable distances. Tabios, or sinaparan, as they are called in the Bikol language, are eaten fried when freshly caught and are pressed into cakes and dried when the market is overstocked. A hungry workman literally eats thousands of fish at a meal.

THE first three months of 1924 seem to have been the healthiest first quarter of a year ever recorded, according to a report of the death-rate of the 15,000,000 industrial policyholders of the Metropolitan Life Insurance Company. The death rate was 9.2 per 1,000 per year, as compared with 9.7 in 1921, which formerly showed the healthiest first quarter. Improvement is shown for almost every cause of death, except automobile accidents, which show the usual increase. For the first time since 1920 there was a drop in the mortality from alcoholism. The number of suicides declined as did the number of deaths from diabetes, the last being attributed to the increasing use of insulin as a remedy.

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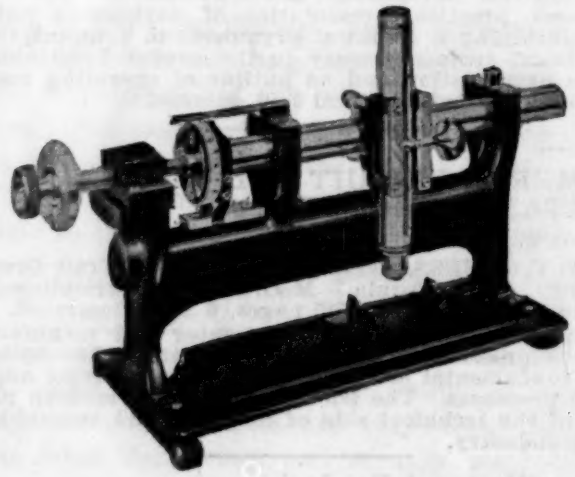

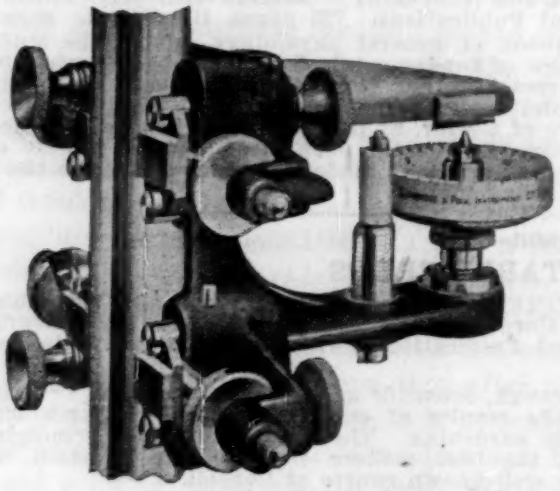

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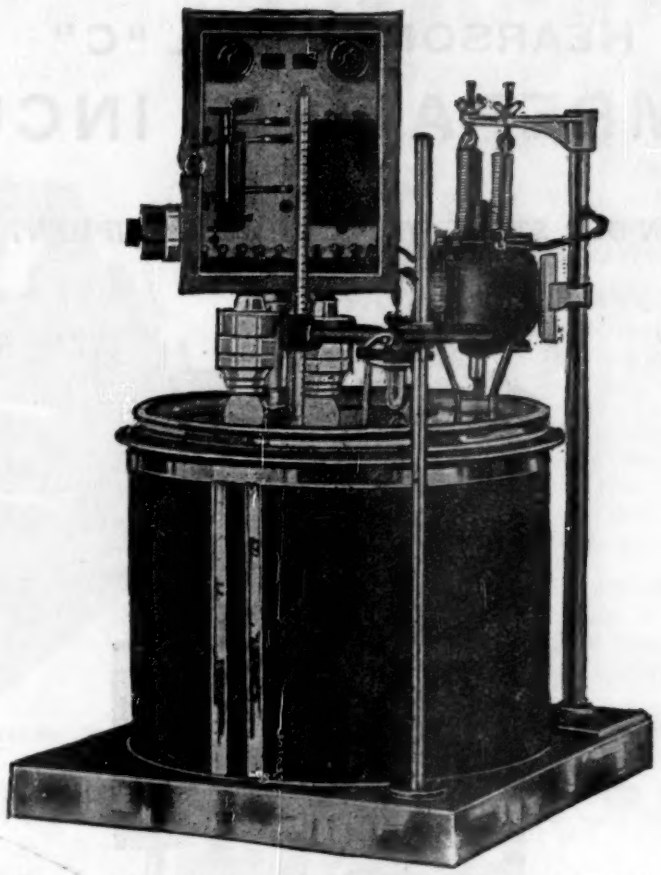

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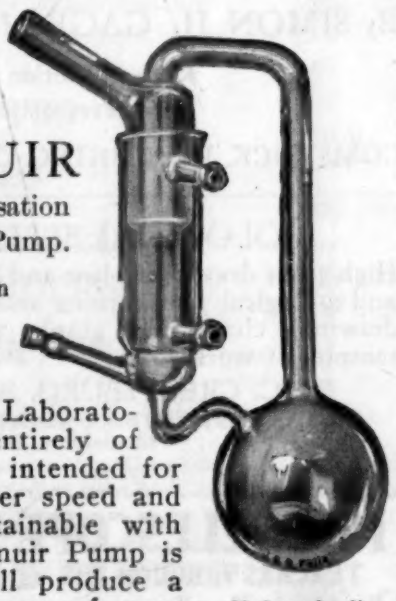

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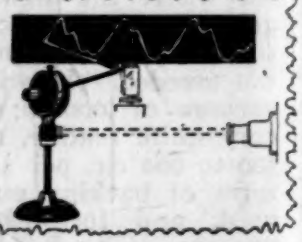

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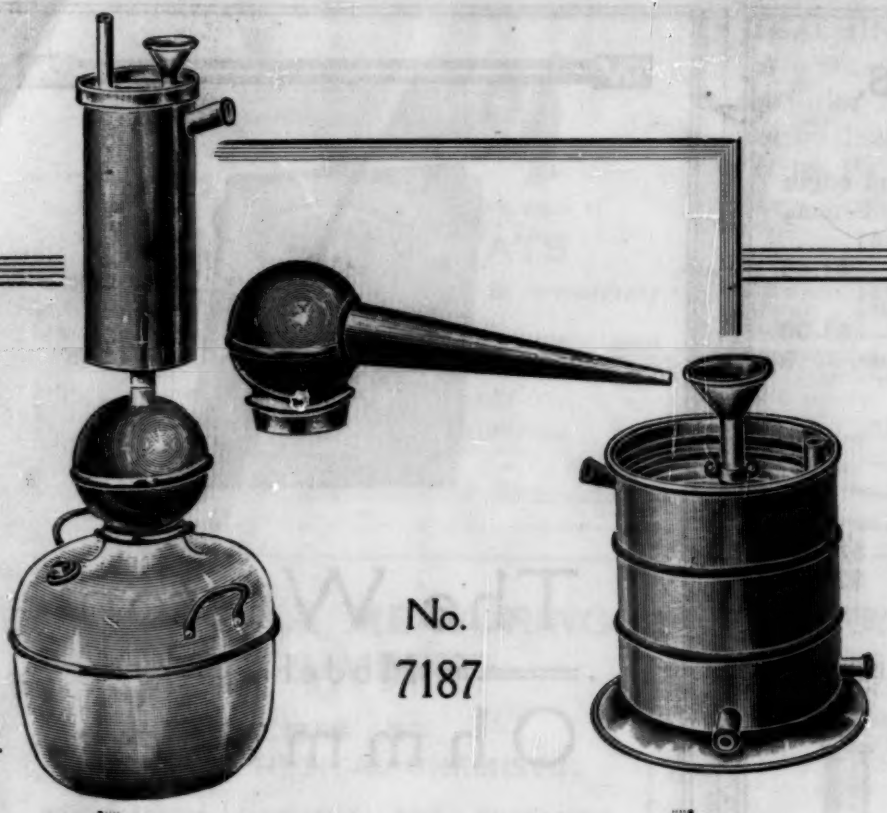

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